826   Symbolic Numerical System

Let A be an alphabet defined by a list of k different symbols,

$$A = [s_0, \ldots, s_k] \qquad (k \geq 3),$$

and $p(\cdot)$ the function that associate to each symbol of the alphabet the corresponding position in the list (first element with position zero). The symbols in the alphabet will be called *digits* and are assumed to be one character length. Fix a digit b of the alphabet, called the base, such that $p(b) \geq 2$. Then, for any integer N there exists a sequence of r digits $d_0, \ldots, d_{r-1}$ (r depending on N) satisfying $p(d_i) < p(b)$ ($i = 0, \ldots, r-1$) and such that N can be decomposed in the following way:

$$
\begin{aligned}
N &= p(d_0) \times [p(b)]^0 + p(d_1) \times [p(b)]^1 + \ldots + p(d_{r-1}) \times [p(b)]^{r-1} \\
&= p(d_0) + p(d_1) \times p(b) + \ldots + p(d_{r-1}) \times [p(b)]^{r-1}.
\end{aligned}
$$

We say that N is represented (under the alphabet A) in base b as

$$(d_{r-1} \ldots d_1 d_0)_b.$$

For example, let $A = [0, 1, 2, 3, 4, 5, 6, 7]$. As far as the decimal number 2548 is equal to

$$
\begin{aligned}
& 0 + 0 \times 7 + 3 \times 7^2 + 0 \times 7^3 + 1 \times 7^4 \\
= \ & p(0) + p(0) \times p(7) + p(3) \times [p(7)]^2 + p(0) \times [p(7)]^3 + p(1) \times [p(7)]^4,
\end{aligned}
$$

it is represented in base 7 as

$$(10300)_7$$

Another example: the usual binary system is obtained choosing $A = [0, 1, 2]$ and $b = 2$.

Given an alphabet A, not containing the symbol question mark (?), and given (partial information about) three numbers represented in an unknown base b, write a program that determines, if possible, the base b for which the third number is the sum of the first two. If there are several solutions, the base b with the smallest position $p(b)$ must be presented. Assume that the maximum length of the alphabet and of the numbers is 70 characters.

Input

The input begins with a single positive integer on a line by itself indicating the number of the cases following, each of them as described below. This line is followed by a blank line, and there is also a blank line between two consecutive inputs.

The input contains four lines terminated by newline character. The first defines the alphabet A; the others the three numbers, possibly with some digits deleted (marked with the question mark symbol). To ensure the uniqueness of the output, it is assumed that for the same position the three numbers have at most one digit deleted (at most one question mark symbol for each position).

Output

For each test case, the output must follow the description below. The outputs of two consecutive cases will be separated by a blank line.

In the output write four lines: the first with the desired base; the others with the three numbers completely specified (the question marks must be replaced with the appropriate digits). If the sum is not possible, there must be no output.

Sample Input

```
1

*!30zx9bdk
?z
b
!*?
```

Sample Output

```
d
bz
b
!*0
```