Problem L. Latin Words

Time limit: 5 seconds
Memory limit: 1024 mebibytes

This is an interactive problem.

A permutation p of letters from the Latin alphabet is secretly written down by the jury, represented as a string of length 26 consisting of distinct uppercase Latin letters.

You can make queries of the following type: for a given substring $p_{i,j}$ from the i-th to the j-th position of the string p inclusive (that is, the string $p_i p_{i+1} \dots p_j$), output the maximum value of a valid Roman numeral that is a substring of $p_{i,j}$.

For example, if the substring is MRC, the output will be 1000 (you can read two numbers: 1000 at positions 1-1, and 100 at positions 3-3; $1000 > 100$). For the substring MIPT, the output will be 1001 (the number at positions 1-2), for the substring HSE — the output will be 0 (no Roman numerals are present), for the substring GCD — the output will be 500 (although there is the string CD at positions 2-3, its value 400 is less than the value of the string D at positions 3-3), and for the substring LCM, the output will be 1000 (valid numbers are present at positions 1-1, 2-2, 3-3, 2-3; the maximum of them is 1000).

Your task is to guess the positions of the letters I, V, X, L, C, D, M, which are used in the representation of Roman numerals, in no more than 19 queries, and to output the lexicographically smallest permutation in which these 7 letters are placed in the required positions.

We remind you of the modern way of writing Roman numerals (the table is taken from Wikipedia):

Place Value	Thousands	Hundreds	Tens	Units
1	M	C	X	I
2	MM	CC	XX	II
3	MMM	CCC	XXX	III
4		CD	XL	IV
5		D	L	V
6		DC	LX	VI
7		DCC	LXX	VII
8		DCCC	LXXX	VIII
9		CM	XC	IX

Note that:

- The numbers 4, 9, 40, 90, 400, and 900 are written in subtractive notation, where the first symbol is subtracted from the second (for example, for 40 (XL), 'X' (10) is subtracted from 'L' (50)). This is the only place where subtractive notation is used.
- A number containing multiple decimal digits is constructed by appending the Roman equivalent of each digit from the most significant to the least significant.
- If the decimal digit is 0, no digits are written in the Roman representation for that place.
- The largest number that can be represented in the Roman numeral system is 3999 (MMMCMXCIX).

Interaction Protocol

The interaction begins with the jury program outputting a single integer t — the number of scenarios ($1 \le t \le 10^4$).

In each scenario, the interaction is started by the participant's program, which outputs a query in the form ? l r, where $0 \le l \le r \le 25$ — the index of the first and last characters in the string p (the characters are numbered from zero). In response, the jury program will output a single integer — the maximum value of a valid Roman numeral that is a substring of $p_{i,j}$. You can make no more than 19 such queries per scenario.

If your program is ready to provide an answer, output !, followed by the string that is the lexicographically smallest permutation of uppercase Latin letters, in which the positions of the letters I, V, X, L, C, D, M correspond to the positions of these letters in the guessed permutation. Outputting the answer does not count as a query. If the answer is output correctly, the interaction proceeds to the next scenario, if there is one, or ends.

It is guaranteed that the original permutation does not change during the interaction, i.e., the interactor is not adaptive.

Example

standard input	standard output
2 1000 500 1000 5 1 10 50 100 1009 50 0 100 500 1009 1009 5	? 0 10 ? 0 5 ? 0 6 ? 0 1 ? 0 0 ? 0 2 ? 2 3 ? 4 4 ! IVXLCDMABEFGHJKNOPQRSTUWYZ ? 10 25 ? 10 10 ? 0 9 ? 11 11 ? 11 12 ? 13 25 ? 13 15 ? 16 16 ! ABEFGHJKNOLCDMIXVPQRSTUWYZ