Problem D. The Shortest does not Mean the Simplest

Input file:	`nosimple.in`
Output file:	`nosimple.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

Your are given integer numbers A, B and C. Output the remainder of division A^B (B-th power of A) by C.

Input

The only line of the input file contains three integers: A, B, C ($1 \leq A, B, C \leq 10^{18}$). Numbers are separated by spaces.

Output

Output file must contain only one non-negative integer less than C — the answer to the problem.

Example

nosimple.in	nosimple.out
3 4 5	1

Problem E. Watermelons of the Field of Wonder of the Fool's Land

Input file:	`melons.in`
Output file:	`melons.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

The world financial crisis defeated the economics of the Fool's Land, and Buratino decided to cultivate watermelons for additional income. Of course, for the business he started to use the famous Field of Wonder. Because of the special diligence (or maybe because of the wonderful features of the Field of Wonder), the speed of growth of each watermelon was not changed in time, but could be different for different watermelons. Watermelons of the Field of Wonder become very famous and attractive for tourists.

When Buratino noticed that tourists like photos with watermelons, he also introduced the new service for VIP tourists: photo with the heaviest watermelon.

One day he simultaneously measured the weights and the speeds of growth of all watermelons. Then for any K-th day after this day he can compute the weight of any watermelon by the formula $W_K = W_0 + S \cdot K$, where W_0 is the initial weight and S is the speed of growth for this watermelon.

Buratino is too lazy to carry out all these computations every day by hand and asks you to help him. Write a program that will find the heaviest watermelon at the given day.

Input

First line of input file contains one integer N — the number of watermelons ($1 \le N \le 10^5$). Each of the next N lines contains two single space separated integers W_0 and S ($1 \le W_0, S \le 10^9$) — the initial weight and the speed of growth for the corresponding watermelon.

The next line contains one integer M — the number of days for which you have to find the heaviest watermelon ($1 \le M \le 10^5$). Each of the last M lines of the input contains one positive integer, indicating day number K ($1 \le K \le 10^9$) for which you have to answer the task question.

Output

Output file should contain M lines — one line for each day in the same order as in the input. On the corresponding line output one integer — the number of the heaviest watermelon for this day. In case when there are several such watermelons, output the minimal number of such watermelon. Watermelons are enumerated from 1 to N in order they appear in the input.

Example

melons.in	melons.out
3	3
1 4	1
4 3	2
8 1	
3	
1	
3	
2	

Problem F. Martian King

Input file:	`king.in`
Output file:	`king.out`
Time limit:	2 seconds
Memory limit:	256 megabytes

There is a small Kingdom on Mars. There are some cities in the Kingdom, some of them are regional centers. The Kingdom has also a capital which may be a regional center or not. Cities are connected with one-way roads. Some of the roads are red and the remaining ones are blue. There is no more than one road of each color getting out of each city.

There is a tradition that the King goes to a trip each year. The trip starts from the capital city and consists of L roads. The trip must end in some regional center. In historical-aesthetic purposes, the sequence of colors of visited roads is written in Chronicles. The red road is denoted by character '0', and the blue road is denoted by '1', so the result is a sequence of L binary digits.

Young Martian Vasja studies history. Recently he found some parts of Chronicles describing the period of ruling of the King Ares. Vasja discovered the following requirement that should have been satisfied by the King. Each year the King must choose a new route, the sequence of which is greater than the corresponding one for previous year. When comparing, sequences are interpreted as binary numbers with leading zeros allowed. In the first year of his ruling the King was allowed to choose any route he wished. If the King is unable to find the route, he must finish his ruling. Vasja also discovered that Ares was very smart and he always chose such routes that maximized the length of his ruling period.

Since Vasja has only parts of Chronicles, he cannot answer some questions. For example:

- Which was King's route in K-th year of his ruling (years of ruling are enumerated starting from 1)?

- In which year Ares chose a route denoted by a given sequence S?

- Which route he chose after the route denoted by a given sequence S?

- Which route was chosen before the route denoted by a sequence S?

Vasja is not so smart as Ares so he asks you to answer the questions mentioned. Write a program that answers them.

Input

The first line of the input contains five integers N, M, F, L, Q — the number of cities, roads, regional centers; the length of King's route and the number of Vasja's questions ($1 \le N \le 50$, $1 \le M \le 100$, $1 \le F \le N$, $1 \le L \le 60$, $1 \le Q \le 10\,000$). The cities are enumerated with integers from 1 to N. The capital has number 1.

The following M lines describe the road system — three numbers in each line: A_i, B_i and C_i. Their meaning is that the i-th road is going from city number A_i to city number B_i, and its color is C_i ('0', if the road is red, '1', if it is blue).

The next line contains F different integers — the numbers of cities, that are regional centers.

The last Q lines contain one question each. The format of question description is the following:

- ? K — which route was chosen by the King in K-th year of his ruling ($1 \le K \le 5 \cdot 10^{18}$)?

- ! S — which year the King chose the route denoted by S?

- > S — which route Ares chose after the route denoted by S?

- **< *S*** — which route was chosen before the route denoted by *S*?

The route is denoted by a sequence of *L* characters '0' and '1'.

It is guaranteed that all questions are correct and the answer always exists.

Output

Output file must contain *T* lines, one for each question. For question **! *S*** it is required to output a single decimal integer. For all other questions the line must consist of *L* characters '0' and '1' — the record corresponding to the route.

Examples

king.in	king.out
1 2 1 3 2 1 1 0 1 1 1 1 ? 3 ! 111	010 8
2 3 2 5 4 1 1 0 1 2 1 2 1 0 2 1 ? 5 ! 00010 > 01010 < 01000	00101 3 10000 00101
4 6 1 6 5 1 2 0 2 3 0 3 4 0 4 3 1 3 2 1 2 1 1 1 ? 3 ? 4 > 000111 < 001101 ! 010101	001101 010011 001011 001011 5