Problem A. Cubic Games

Source file name:	games.c, games.cpp, games.java, games.py
Input:	Standard
Output:	Standard
Author(s):	Eddy Cael Mamani Canaviri - Coderoad Bolivia

Ailin is playing a game with her friends. There is a board with N circular boxes, each box has an edge that points to the next box n_i and also an associated value v_i.

Each player starts in one position and moves through the boxes. The total score will be equal to the total accumulated through the path traveled by the player. If a player passes through only one edge his score will be equal to the value of the edge. If the player already has an accumulated score, then the new value will be calculated using the formula:

$$S = \sqrt[3]{A^3 + B^3}$$

$$Where:$$

$$A = \text{previous accumulated score}$$
$$B = \text{new value}$$
$$S = \text{new accumulated score}$$

Now Ailin wants to know who wins the game.

Input

The input file contains several test cases. Each test case starts with a line containing the value of N. Then there are N lines, each line has two values: the number of the destination box n_i from box i $(1 \leq i \leq N)$, and the value of the edge v_i. Below is an integer J, the number of friends in the game. The next line contains Q, the number of queries. Each one of the next Q lines contains J pairs of numbers, the start box s_j and the number of turns each player has k_j. The player with the highest score wins. In case of a tie, the first player who reaches the highest score wins. The first player does all his moves, then the second, and so on.

$1 \leq N \leq 5 * 10^5$
$1 \leq n_i \leq N \qquad 1 \leq i \leq N$
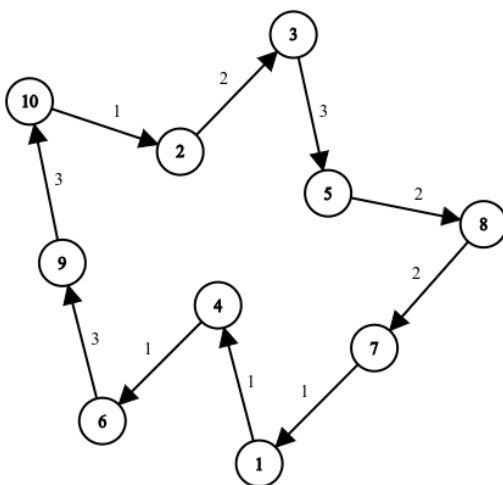$1 \leq v_i \leq 10^4 \qquad 1 \leq i \leq N$
$2 \leq J \leq 20$
$1 \leq Q \leq 5000$
$0 \leq k_j \leq 10^{18} \qquad 1 \leq j \leq J$
$1 \leq s_j \leq N \qquad 1 \leq j \leq J$

Output

For each query print three values, the index of the winning player, the position where the winner finishes, and the maximum score obtained, rounded to five decimals. The following graphic illustrates the sample input:

Explanation

The winner of the second query is the player 2 finishing at position 10. The values in the path are 1, 1, 3, 3. Then his score is: $1 \to \sqrt[3]{1^3 + 1^3} = 1.25992105 \to \sqrt[3]{1.25992105^3 + 3^3} = 3.072316822 \to \sqrt[3]{3.072316822^3 + 3^3} = 3.82586$

The winner in the third query has only a single edge in the path and ends at position 7. So the answer is 2.00000.

Example

Input	Output
10	1 10 3.77976
4 1	2 10 3.82586
3 2	3 7 2.00000
5 3	
6 1	
8 2	
9 3	
1 1	
7 2	
10 3	
2 1	
3	
3	
6 2 2 3 10 3	
3 3 1 4 10 4	
10 1 4 1 8 1	

Use fast I/O methods

Problem B. Tree

Source file name:	tree.c, tree.cpp, tree.java, tree.py
Input:	Standard
Output:	Standard
Author(s):	Eddy Cael Mamani Canaviri - Coderoad Bolivia

Ailin is learning several things about graphs, more specifically about trees. Her father gave her several examples of trees, but she does not like to use several sheets with graphics of the trees. That is why she encodes the trees, so she can write the codes in a single paper. Let's consider the algorithm that encodes a tree of N nodes into a sequence of $N - 2$ values:

Make $n - 2$ steps. At step i, remove the leaf with the smallest number and set the i-th element of the sequence to be the number of its leaf's neighbour. For example, she wants to encode this tree:
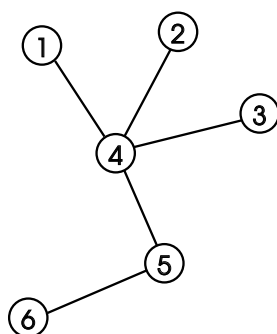
Initially, vertex 1 is the leaf with the smallest number, so it is removed first and 4 becomes the first element in the sequence. Next, Vertices 2 and 3 are removed, so 4 is added two times to the sequence. Vertex 4 is now a leaf and has the smallest number, so it is removed and we append 5 to the sequence. Now there are only two vertices so the process stops. The sequence is 4,4,4,5.

Using this algorithm she encodes the trees easily. But now she wants to recover the trees in order to practice her tasks. She learnt how to encode trees, but she did not learn how to decode them! Can you help her?.

Input

The input file contains several test cases. Each test case starts with a line containing the number of vertices of the tree: N. Next line contains $N - 2$ numbers s_i: the encoded tree.

$2 \leq N \leq 5 * 10^5$
$1 \leq s_i \leq N \qquad 1 \leq i \leq N - 2$

Output

For each case print the $N - 1$ edges (a_i, b_i) of the tree. Each edge must hold $a_i < b_i$. Also, show the edges sorted lexicographically. If it is not possible to reconstruct the tree from the sequence or if the sequence is ambiguous, print "-1" (without the quotes).

Example

Input	Output
6	1 4
4 4 4 5	2 4
2	3 4
	4 5
3	5 6
1	1 2
	1 2
	1 3

Use fast I/O methods

Problem C. Wall Breaker

Source file name:	breakwall.c, breakwall.cpp, breakwall.java, breakwall.py
Input:	Standard
Output:	Standard
Author(s):	Eddy Cael Mamani Canaviri - Coderoad Bolivia

Ailin is playing a game where she has a virtual village. A village consists of several buildings and also several walls. The game also implies attacks over other villages. And obviously, she has an army. Let's suppose that the army has warriors and exactly one wall breaker. The wall breaker can break only a single wall, and the warriors and the wall breaker can't pass trough the walls. The buildings are represented by '#', a single wall by '*' and free spaces by '.'. Note that the village are circumscribed by free spaces where is impossible to put walls or buildings. You can start your attack from one of those free spaces outside of the village and also you can tell to the wall breaker which wall to break, if this wall is reachable, of course. The warriors can reach any adjacent place horizontally, vertically or diagonally. Ailin is attacking a village and she has the layout of it. She wants to destroy the maximum quantity of buildings from the enemy village. Can you calculate it before her?.

Input

The input file contains several test cases. Each test case starts with a line containing the number of rows and columns N, M. Next there are N lines, each line has M characters containing the layout of the enemy village.

$1 \leq N, M \leq 10^3$

Output

For each test case print the maximum amount of buildings that Ailin can destroy if she uses the wall breaker.

Example

Input	Output
3 3	4
#*#	4
***	5
#*#	4
4 3	
#*#	
***	
***	
#*#	
5 5	
*****	
*##**	
***#*	
##*	
*****	
6 6	
******	
##**	
****#*	
*#**#*	
******	
......	

Use fast I/O methods

Problem D. Origami

Source file name:	origami.c, origami.cpp, origami.java, origami.py
Input:	Standard
Output:	Standard
Author(s):	Eddy Cael Mamani Canaviri - Coderoad Bolivia

Ailin is learning about the ancestral Origami art. She is folding some paper sheets and soon, she realizes that the paper sheets must be folded in equal parts (it is also known as axis of symmetry). She is a very curious girl, and now she wants to know how many axes are there in a paper sheet. She needs your help in order to solve the problem. The paper sheet is represented by a polygon with no self intersections (a simple polygon). The polygon consists of N points $(x_i,\ y_i)$ in the plane. Note that an axis of symmetry is different from another if they have distinct angles. Furthermore, she wants to know which is the paper sheet with more axes of symmetry and how many paper sheets have this maximum.

Input

The input file contains several test cases. Each test case starts with a line containing the number of polygons. For each polygon you will have a line containing N, and next N lines that contain the integer coordinates $(x_i,\ y_i)$ of the i-th polygon.
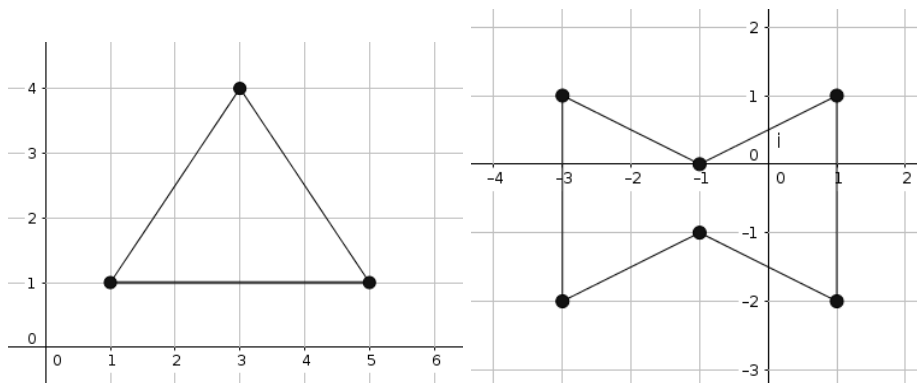
$1 \leq N \leq 2 * 10^5$
$-10^9 \leq x_i, y_i \leq 10^9$
$1 \leq N \leq 2 * 10^5$
It is guaranteed that the total amount of points doesn't exceed 10^6.

Below you can see the polygons from the sample input:

Output

Print the following information for every testcase: For each polygon print the amount of axes of symmetry. At the end of the case print two numbers: the maximum value among the axes of symmetry and the amount of polygons that have this maximum.

Example

Input	Output
2	1
2	2
3	2 1
1 1	1
5 1	1 1
3 4	
6	
1 1	
-1 0	
-3 1	
-3 -2	
-1 -1	
1 -2	
1	
3	
1 1	
5 1	
3 4	

Use fast I/O methods

Problem E. Talking P

Source file name:	talkingp.c, talkingp.cpp, talkingp.java, talkingp.py
Input:	Standard
Output:	Standard
Author(s):	Grover Ariel Irusta Miranda - CodeRoad Bolivia

Grover came back from a trip and he has a lot to talk about with his friend Eddy, but they have just a little problem, there are too many people around them. Groover has some shame and does not want other people to listen what he is going to tell Eddy. Therefore Grover proposes to Eddy to speak P. It is a fun language game in which words are altered, each vowel is followed by the letter p, followed by the same vowel, (like usually do in Bolivia and other Spanish-speaking countries), the game method is called *jeringoso* in Spanish. Grover is sure that almost nobody will understand them and at least they will have fun for a while talking that way altering the spoken language. Remember that the vowels are: a, e, i, o, u

Input

The first line w ill contain an integer N ($1 \le N \le 10^6$), representing the number of phrases to follow. Each phrase M will contain at least 1 and at most 100 characters in which you must change to *jeringoso*. It is guaranteed that ($1 \le N * |M| \le 10^7$) there are no words that contain "qu", "gui" or "gue" such as: "que", "guia", "ceguera", and so on. All cases are in lowercase, there are commas and dots.

Output

The output will be each one of the phrases changed by the method explained above.

Example

Input	Output
1 tuve un genial viaje.	tupuvepe upun gepenipiapal vipiapajepe.

Use fast I/O methods

Problem F. Gifts

Source file name:	gifts.c, gifts.cpp, gifts.java, gifts.py
Input:	Standard
Output:	Standard
Author(s):	Eddy Cael Mamani Canaviri - Coderoad Bolivia

Ailin is celebrating her birthday! and like all the girls, she likes gifts (perfumes). At night she starts to open the gifts but she realizes that there are a lot of repeated gifts. She doesn't like the repeated things, but she has an idea: first assign a number to every gift (equal gifts receive the same number) and then, put the gifts in a row. From now and every day, she will choose a range $[L, R]$ and a number K, now she wants to use the $K - th$ perfume among the unique perfumes in the range (the $K - th$ perfume is chosen by its position in the row). There are a lot of perfumes and she wants to know which perfume to use every day. Can you help her?

Input

The input file contains several test cases. Each test case starts with a line containing the number of gifts N. Next line contains the N numbers G_i that Ailin assigned to the gifts. Next line contains the number of queries Q, and next Q lines contains three numbers: L_j, R_j, K_j.

$1 \leq N \leq 5 * 10^5$

$1 \leq G_i \leq 10^9 \qquad \forall \qquad 1 \leq i \leq N$

$1 \leq Q \leq 5 * 10^5$

$1 \leq L_j, R_j \leq N \qquad 1 \leq K_j \leq N \qquad \forall \qquad 1 \leq j \leq Q$

$L_j \leq R_j$

Output

For every query, print the value of $K - th$ perfume, if there are several perfumes with the same value in the range $[L_j..R_j]$ use the rightmost value. If there are less unique perfumes than K_j print ":(" without the quotes. For each query assume Ailin doesn't change the initial order of the perfumes.

Example

Input	Output
6	3
1 2 3 2 1 3	2
4	1
1 5 1	:(
2 5 2	
2 5 3	
1 6 4	

Use fast I/O methods

Problem G. Order of Implementation

Source file name:	implementation.c, implementation.cpp, implementation.java, implementation.py
Input:	Standard
Output:	Standard
Author(s):	Ariel Richard Condori Rodriguez - UTO Bolivia

Craig Larman in his book "Applying UML and Patterns" shows a possible order of implementation of entities. An engineer changed the used method and had to create other possible order of implementation. This one includes levels and dependencies that are helpful in planning to the new software engineer.

The basic method is:

- Sum all dependencies for every entity and calculate its level, the result is a pair <level, dependency> The rules to calculate level are:
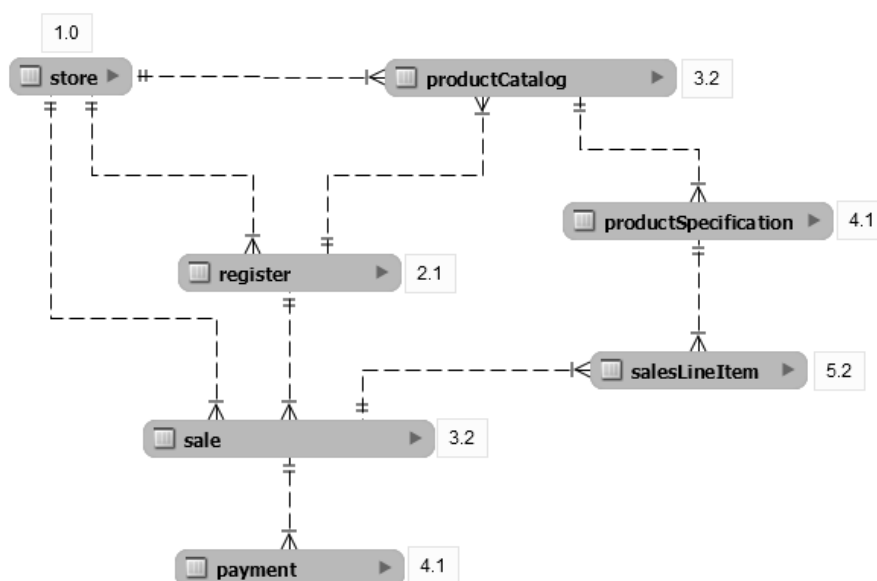
- A dependency is a parent entity.

- Choose the maximum level of all its dependencies and add one.

$$Level = max(dep1,\ dep2,\ dep3,\ \ldots) + 1$$

- If an entity has no dependencies, then its level is 1.

$$Level = 1$$

The diagram is a conected directed acyclic graph. For example, the order of implementation is:

Input

The input file contains several test cases. The first line of each test case contains a number N, this one is the number of diagram relations, where $1 \le N \le 5 * 10^5$. The following N lines contains a pair <source, target> separated by a space. Length of source and target will be less than or equal to 60 characters. N is read until end of file.

Output

The output for each case is the order of implementation sorted ascendingly by level, dependency and entity name. Please take care of the format: *level.dependency entityName*

Example

Input	Output
9	1.0 store
store productCatalog	2.1 register
store register	3.2 productCatalog
register productCatalog	3.2 sale
productCatalog productSpecification	4.1 payment
register sale	4.1 productSpecification
store sale	5.2 salesLineItem
productSpecification salesLineItem	1.0 T1
sale salesLineItem	2.1 T2
sale payment	3.1 T3
10	4.1 T4
T1 T2	5.1 T5
T2 T3	6.1 T6
T3 T4	7.1 T7
T4 T5	8.1 T8
T5 T6	9.1 T9
T6 T7	10.1 T10
T7 T8	11.1 T11
T8 T9	
T9 T10	
T10 T11	

Use fast I/O methods

Problem H. Sub Sum

Source file name:	subsum.c, subsum.cpp, subsum.java, subsum.py
Input:	Standard
Output:	Standard
Author(s):	Jorge Teran - UMSA Bolivia

Given a vector V you want to calculate the sum of a contiguous group such these sum is equals to S. You can't reorder the vector.

For example if you have a vector with six elements:

1	2	3	4	5	6
2	8	2	6	3	5

If we want to calculate the elements whose sum is 16, we can see that the elements 2, 3, 4 sum up to 16 ($8 + 2 + 6 = 16$). Also the numbers $2 + 6 + 3 + 5 = 16$. But the correct answer must be 2, 4 , it means that we must sum from the position 2 to the position 4 inclusive.

Input

The input has several test cases. Each test contains two lines, the first one with the amount of numbers N ($0 \leq N \leq 10^5$) and with the target sum S ($1 \leq S \leq 10^{14}$) of contigous elements asked before. The second line contains N vector's elements separated by spaces. The elements are nonnegative.

You must read until end of file.

Output

The output must have two numbers per line, representing the range whose sum is equal to S. If there are no answer, print -1. If there are several possibilities, print the leftmost.

Example

Input	Output
6 16	2 4
2 8 2 6 3 5	1 2
7 5	8 8
1 4 4 1 0 0 5	1 6
8 6	6 6
7 1 0 9 4 9 2 6	
9 32	
7 9 3 6 4 3 2 5 2	
10 4	
2 5 7 5 8 4 9 2 6 9	

Use fast I/O methods

Problem I. Smallest Greater

Source file name:	smallgreater.c, smallgreater.cpp, smallgreater.java, smallgreater.py
Input:	Standard
Output:	Standard
Author(s):	Jorge Teran - UMSA Bolivia

Given an integer M you want to find the smallest number P greater or equal to M such P has K bit in a row in its binary representation.

For example if $M = 2$ y $K = 3$ the binary representation for M is 10 so the smallest number P with 3 bits in a row, such P is greater or equal to 2 is 7, given that its representation is 111, so $P = 7$

If $M = 10$ y $k = 3$ then the binary representation of 10 is 1010, so $P = 14$ with a binary representation of 1110.

If $M = 7$, y $k = 3$ the answer is $P = 7$.

Input

The input has several test cases, each one contains two integers: M and K.

$(0 \le M \le 2^{50})$ y $(1 \le K \le 50)$.

Output

For each case print the number P described above.

Example

Input	Output
2 3	7
10 3	14
1 2	3
5 2	6
1023 11	2047
7 2	7

Use fast I/O methods

Problem J. Hulam's Sequence

Source file name:	hulam.c, hulam.cpp, hulam.java, hulam.py
Input:	standard
Output:	standard
Author(s):	Hugo Humberto Morales Peña - UTP Colombia

A Hulam Number is a small variant of the Ulam Number. The standard Hulam sequence (the $(1, 2)$-Hulam sequence) starts with $H_1 = 1$ and $H_2 = 2$. Then for $n > 2$, H_n is defined to be the smallest integer that is not the sum of two distinct earlier terms and larger than all earlier terms.

As a consequence of the definition, 3 is not a Hulam number $(1 + 2 = 3)$, while 4 is a Hulam number, because it is the smallest integer that is not the sum of previous terms. The integers 5 and 6 are not Hulam number, because $5 = 1 + 4$ and $6 = 2 + 4$. The next Hulam number is the integer 7.

For this problem, you have to write a program that calculates the n-th term in Hulam's sequence. That is, determine H_n.

Input

Input begins with an integer t $(1 \le t \le 4 \times 10^3)$, the number of test cases, followed by t lines, each line contains an integer n $(1 \le n \le 10^4)$.

Output

For each test case, you should print a single line containing the value of H_n.

Example

Input	Output
10	1
1	2
2	4
3	7
4	10
5	13
6	16
7	19
8	22
9	25
10	

Use fast I/O methods

Problem K. Palindrulam

Source file name:	palindrulam.c, palindrulam.cpp, palindrulam.java, palindrulam.py
Input:	Standard
Output:	Standard
Author(s):	Eddy Cael Mamani Canaviri - Coderoad Bolivia

Ailin is learning algorithms about strings, and now she wants to know when a sub segment is palindrome. Easy right? She has N numbers in a row and Q queries. She wants to solve the problem but she is a bit tired because yesterday she was studying Ulam Numbers. She learned this topic in the professor Humbertov Moralov's classroom. Ailin now has a lot of queries, so she need support to get answers quickly.

Input

The input file contains several test cases. Each test case starts with a line containing the number of elements in the row N, next line contains the N elements a_i. The following line contains a number Q, the number of queries, the next Q lines contains the queries in the format:

$U\ Pos\ Value$: Update the element in the position pos with $Value$. It means: $a[pos] = Value$

$G\ L\ R$: if the segment beginning at L and ending at R (inclusive) is palindrome print "Y", print "N" otherwise.

Please note that Ailin is interested in the sequence of numbers. Please take care of the last test case in the sample input.

Ailin thinks it is boring, so she is interested in the cases when segment $[L,\ R]$ is palindromic and L or R are Ulam Numbers.

Remember that the Ulam sequence (the $(1, 2)$-Ulam sequence) starts with $U_1 = 1$ and $U_2 = 2$. Then for $n > 2$, U_n is defined to be the smallest integer that is the sum of two distinct earlier terms in exactly one way and larger than all earlier terms.

As a consequence of the definition, 3 is an Ulam number $(1 + 2)$, and 4 is an Ulam number $(1 + 3)$, here $2 + 2$ is not a second representation of 4, because the previous terms must be distinct. The integer 5 is not an Ulam number, because $5 = 1 + 4 = 2 + 3$.

$1 \le N, Q \le 5 * 10^5$
$1 \le a_i \le U_{10000}$
$1 \le L, R, Pos \le N$
$L \le R$
$1 \le Value \le U_{10000}$

Output

For each query print the aswer detailed above.

Example

Input	Output
7	Y
2 4 3 6 3 2 5	N
7	Y
G 3 5	N
G 2 6	Y
U 6 4	Y
G 2 6	
U 1 5	
G 1 7	
G 2 2	
4	
16 18 16 5	
1	
G 1 3	

Use fast I/O methods