Problem A. Easy Chess

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`White`

Omar was watching a lot of chess videos lately, he fell asleep last night watching one of them and he had a really strange dream.

Omar dreamed that **he was the king piece** of a chessboard, and he was **alone** facing some really angry chess pieces. Being a really good chess player, he knew right away how would his situation unfold, whether he could escape or not.

The next day, *Omar* woke up and decided to challenge you. He drew the chessboard he dreamed about and wants you to tell him if the king can make **at least** one move or not.

The pieces move as they would in normal chess. For more info about movements check the notes section.

Input

The first line of input contains the number of test cases T where $(1 \leq T \leq 30)$.

The following $T * 8$ lines contain 8 characters each.

Each cell contains either King, Queen, Pawn, Knight, Bishop, Rook, or an empty cell ['K', 'Q', 'P', 'N', 'B', 'R', '.'], respectively.

It is guaranteed that there is exactly 1 King on the Chessboard.

It is guaranteed that there are at most 15 other pieces of any type on the Chessboard.

The board is given to you representing the side of the chess pieces, opposite to *Omar*. (i.e. the pawns move upwards in the grid)

Output

Print "Yes"or "No"(case insensitive), the answer to the problem.

Example

standard input

```
2
....K...
........
........
........
........
........
PPPPPPPP
RNBQ.BNR

N.....KR
....Q...
..QN....
.B.RQ...
.Q...RB.
R......P
...P....
...N....
```

standard output

```
Yes
No
```

Note

The empty line between the two test cases is just for readability and it is **NOT in the actual test set.**

The king may move to any adjacent square in the 8 directions.

The king can attack pieces.

The rook may move any number of squares horizontally or vertically without jumping.

The bishop moves and captures along diagonals without jumping over intervening pieces.

The queen is able to move any number of squares vertically, horizontally, or diagonally without jumping over intervening pieces.

The knight may move two squares vertically and one square horizontally or two squares horizontally and one square vertically, jumping over other pieces.

The pawn may move one vacant square directly forward, and it may capture one square diagonally forward.

Problem B. Even Is The King Now

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Purple`

Today is a special day, It's the day where the *Evens* rule the world and become the kings over the *Odds*. In order for the *Odds* to live in peace they have to eliminate all the *bad* sequences.

A sequence is called *bad* if you can't find a subsequence with a **positive even** sum, as this is a hard task to do, they even want to impress the *Evens* more by finding the **maximum positive even** sum of a subsequence from this sequence.

It's a battle of knowledge and the *Odds* has to earn their position back, so can you help them?

Input

In the first line, you will be given an integer N the size of the sequence A ($1 \leq N \leq 2 \cdot 10^5$).

In the second line, you will be given N integers the elements of the sequence A ($0 \leq A_i \leq 10^9$).

Output

If the sequence is bad print -1. Otherwise, print one integer which is the maximum positive even sum of a subsequence from the given sequence.

Examples

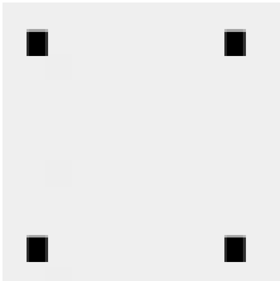
standard input	standard output
5 2 71 9 1 18	100
2 0 5	-1

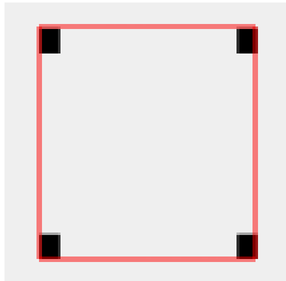
Problem C. Square Up!

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Gray`

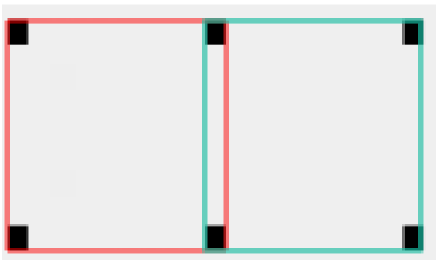
Olajide Olatunji and his friends bought a new house. The house is represented as a grid of n rows and m columns. Each cell of the grid is either empty '.' or blocked '#'.

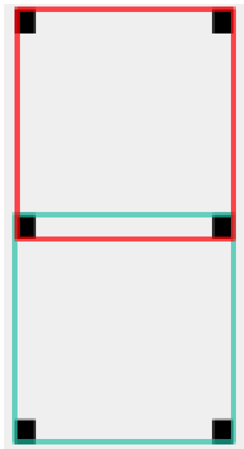
A square foot is composed of 4 empty cells. Example of 4 empty cells and 1 square foot, respectively:





2 Square feet are connected if they have 2 cells in common. They can be only of the following forms:





Olajide is greedy; he wants to keep the maximum number of connected square feet to himself. Help him find the maximum number of connected square feet.

Input

The first line contains 2 integers n and m ($1 \leq n \cdot m \leq 5 \cdot 10^5$) – the number of rows and the number of columns, respectively.

The following n lines contain m characters, each character is either '.' or '#'.

Output

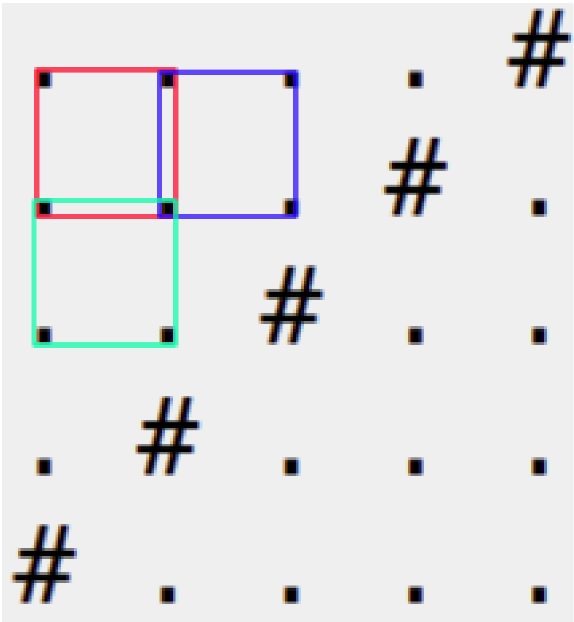
Print the maximum number of connected square feet.

Examples

standard input	standard output
3 4 ...# .... .#..	2
5 5 ....# ...#. ..#.. .#... #....	3

Note

In the second test case, the maximum number of connected square feet can be represented as follows:



Problem D. Sailboat

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Dark green`

Captain *Aquz* is the captain of the famous sailboat *Columbia* and you are his trusty sailor. The captain wants the sailboat to sail in certain directions, and your job is to tell him the new position of the sailboat after sailing in that direction.

The sea is represented by the 2D coordinate plane and, there are N lighthouses scattered across the sea where each lighthouse is at a unique integer point (X_i, Y_i).

The sailboat is initially at point (X, Y) and, the captain will give you Q queries. For each query, you will be given a direction (Up, Down, Left, or Right) to sail the boat in.

If the sailboat reaches the position of a lighthouse after sailing in that direction for an indefinite amount of time, the boat sails in that direction and stops at the first lighthouse it reaches. If not, the boat stays at its current position.

Input

The first line of input contains a single integer N $(1 \leq N \leq 10^5)$, the number of lighthouses.

The second line of input contains two integers X, Y $(-10^9 \leq X, Y \leq 10^9)$, the sailboat's initial position.

Each of the following N lines contains two integers X_i, Y_i $(-10^9 \leq X_i, Y_i \leq 10^9)$, the position of the i_{th} lighthouse.

The following line contains a single integer Q $(1 \leq Q \leq 10^5)$, the number of the captain's queries.

Each of the following Q lines contains a single uppercase character I $(I \in \{U, D, L, R\})$. Up, Down, Left, or Right respectively. the direction the captain wants the sailboat to sail in.

Output

Output Q lines, each line contains integers X_i, Y_i, the new position of the sailboat after the captain's query.

Example

standard input	standard output
6 0 0 1 0 2 0 1 2 1 3 -3 2 -3 3 6 R U R U L D	1 0 1 2 1 2 1 3 -3 3 -3 2

Note

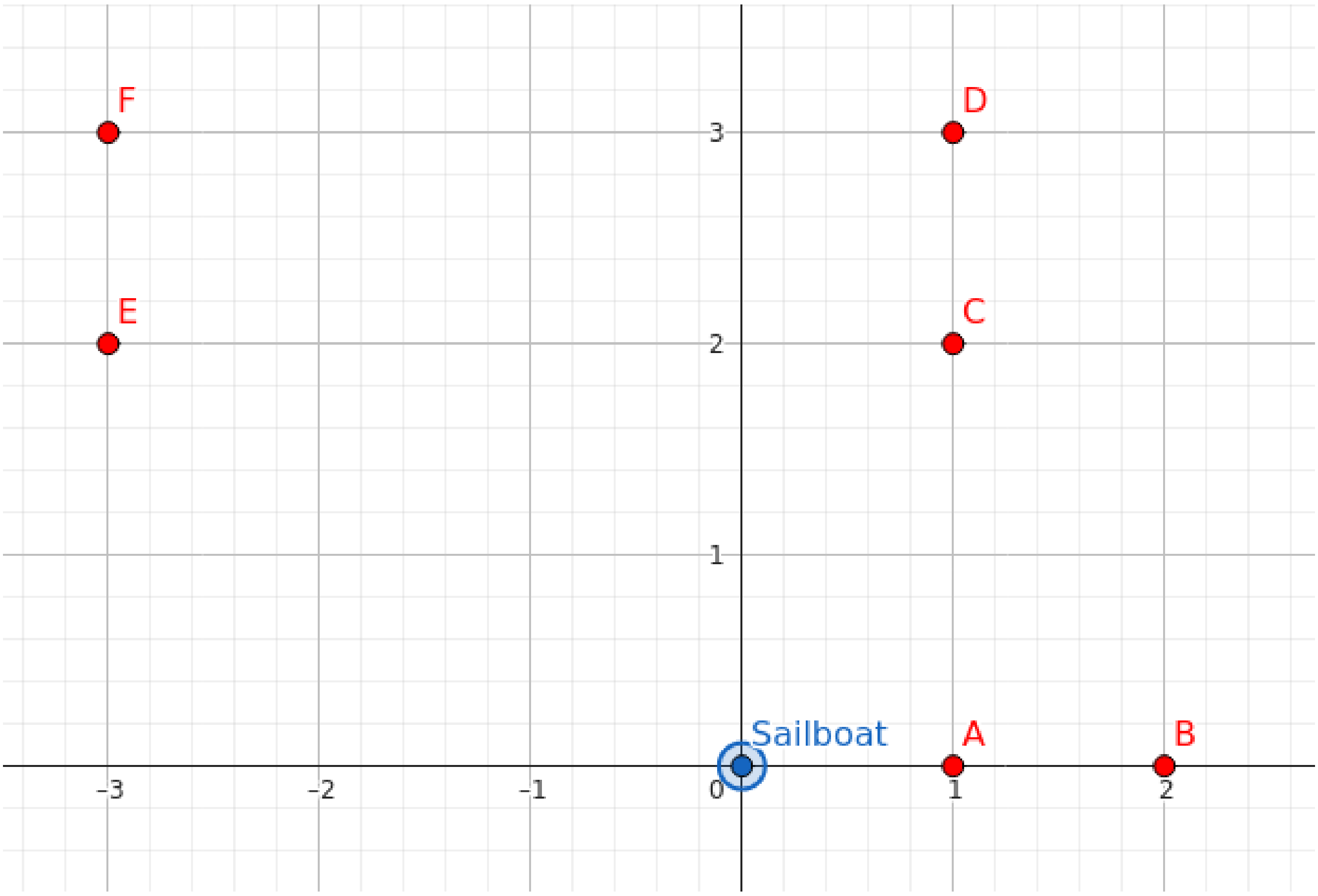
The initial position of the sailboat is **NOT necessarily at a lighthouse.**

Moving right (R) means moving in the positive direction of the X-Axis.

Moving left (L) means moving in the negative direction of the X-Axis.

Moving up (U) means moving in the positive direction of the Y-Axis.

Moving down (D) means moving in the negative direction of the Y-Axis.



The first test case

Problem E. Name

Input file: `standard input`
Output file: `standard output`
Balloon Color: `Orange`

Given two integers n and k ($k \leq 10$), and a permutation of the first k lowercase Latin letters, count the number of distinct strings of length n that can be made from the first k characters such that the following condition holds:

- For every pair of characters that appear in the string, the relative order of their **first** occurrences in the string must match their relative order in the permutation.

  (i.e., if characters $'a'$ and $'b'$ appear in the string and $'a'$ comes before $'b'$ in the permutation, then the first occurrence of $'a'$ in the string must come before the first occurrence of $'b'$)

As the number of these strings may be large, print it modulo $10^9 + 7$.

Input

The first line of the input contains two integers n ($1 \leq n \leq 10^5$) which represents the size of the string, and k ($1 \leq k \leq 10$) which represents the size of the permutation.

The second line contains a permutation of the first k Latin letters.

Output

Print the number of strings satisfying the constraints above modulo $10^9 + 7$.

Examples

standard input	standard output
2 3 b a c	6
5 3 b a c	73
9 5 a e b d c	78606

Note

These are all valid strings in the first test case: {bb, ba, bc, aa, ac, cc}.

Considering the second example:

These are some of the valid strings (these are some of the valid strings, not all of them):

- "aaaaa": this string consists only of the character 'a', so there is no problem.
- "baabc": the first occurrence of 'b' is at position 1, the first occurrence of 'a' is at position 2, the first occurrence of 'c' is at position 5, so the relative order of the first occurrence of the 3 characters match with their relative order in the permutation (first occurrence of 'b' appears before first occurrence of 'a', and first occurrence of 'a' appears before first occurrence of 'c').
- "bbbab": the first occurrence of 'b' is at position 1, the first occurrence of 'a' is at position 4, so the relative order of the first occurrence of 'a' and 'b' match with their relative order in the permutation, note that in this case we don't care about the character 'c' because it doesn't appear in the string, so we only care about the relative order of 'a' and 'b'.

- "bcccc": the first occurrence of 'b' is at position 1, the first occurrence of 'c' is at position 2, so the first occurrence of 'b' comes before the first occurrence of 'c', so the relative order of the first occurrence of 'b' and 'c' match with their relative order in the permutation.

And there are some of the invalid strings (some of them, not all):

- "caaac": the first occurrence of 'c' is at position 1, the first occurrence of 'a' is at position 2, so the first occurrence of 'c' comes before the first occurrence of 'a', but in the permutation the character 'c' comes after the character 'a', so the string is invalid.
- "bcaaa": the relative order of the first occurrence of the characters 'b' and 'c' matches the permutation, also the relative order of the first occurrence of the characters 'b' and 'a' matches, but the relative order of the first occurrence of the characters 'a' and 'c' doesn't match, so the string is invalid.
- "ccaaa": the first occurrence of 'c' is at position 1, the first occurrence of 'a' is at position 3, so the relative order of their first occurrences doesn't match the relative order of them in the permutation.

Problem F. Odd subarray

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Blue`

Given an array of size n, find the longest odd subarray of the array a.

Odd subarray is called odd if it has exactly one odd element.

A subarray of the array a is a sequence a_l, a_{l+1}, ..., a_r for some integers (l, r) such that $(1 \le l \le r \le n)$.

Input

The first line contains a single integer n $(1 \le n \le 2 \cdot 10^5)$, the size of the array.

The second line contains n integers $(1 \le a_i \le 10^9)$, elements of the array.

Output

If there is no answer print -1.

Otherwise print the answer in a single line, the length of the longest odd subarray.

Examples

standard input	standard output
6 1 5 4 2 3 2	4
4 8 12 6 10	-1

Note

In the first example, the longest odd sub-array is $(3, 6)$.

In the second example, there are no odd numbers in the whole array so the answer is -1.

Problem G. Maximizing Results

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Red`

You are given an array of n integers, and two integers m and k.

At first, you are allowed to perform no more than k operations on the array. At each operation, you can change the sign of any value of the array(from negative to positive or vice versa).

After that, you should choose exactly m elements from the array to multiply and try to get the maximum product. In other words you need to choose m elements a_1, a_2, .. a_m such that $a_1 \times a_2 \times .. \times a_m$ is maximum as possible.

You should print the maximum product at the end modulo $10^9 + 7$ as the product can be very large.

Input

The first line of input contains three integers n ($1 \le n \le 2 \times 10^5$), m and k ($1 \le m, k \le n$).

The second line contains n integers a_i ($-10^9 \le a_i \le 10^9$).

Output

Print the maximum product of the m numbers modulo $10^9 + 7$

Examples

standard input	standard output
4 2 2 4 -10 -9 1	90
6 4 6 8 -10 22 1 9 -2	15840

Problem H. Coach Beevo's Primes

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Cyan`

For his 420-th birthday, *Coach Beevo* recieved a number X which has n prime factors. As he was happily walking around with it, he tripped on **"a tree rooted at index 1"** planted by his evil nemesis *Oveeb*. Upon his fall, the number X shattered and the prime factors were scattered across the floor. While collecting his prime factors, he remembered the famous quote *"Don't put all your eggs in one basket"* and thought of a plan to never allow this to happen again.

He decided that he was going to distribute his prime factors among three numbers a, b, and c. Each factor was going to belong to exactly one of the three numbers so $(a \cdot b \cdot c = X)$. As an extra level of protection from *Oveeb*'s evil plans, *Coach Beevo* decided to make $(a < b < c)$ and have them all be pairwise coprime (i.e., the greatest common divisor between any two numbers of the three is 1).

Help *Coach Beevo* count the number of ways he could distribute his factors in such a manner modulo 998244353.

Input

The first line of input contains an integer t $(1 \le t \le 10^5)$ — the number of test cases.

Each test case consists of two lines, the first contains the integer $(1 \le n \le 10^5)$ — the number of prime factors.

The following line contains n prime numbers p_i $(1 \le p_i \le 10^5)$ — the prime factors where $(\prod_{i=1}^{n} p_i = X)$

The sum of n over all test cases doesn't exceed 10^5.

Output

For each test case, print the answer modulo 998244353.

Example

standard input	standard output
2 3 2 3 5 6 11 7 13 2 19 7	4 40

Note

In the first test case, the possible values of a, b, and c satisfying the conditions are:

$2, 3, 5$

$1, 5, 6$

$1, 3, 10$

$1, 2, 15$

Problem I. Meet Me In The Middle

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Gold`

You are given an array a of size N and you must do the following operation **exactly** K times:

- Choose any existing element in the array and remove it.

Find the least number of unique integers after doing all the K operations.

Input

The first line contains 2 integers N, K $(1 \leq K \leq N \leq 10^5)$.

The second line contains N Integers $a_1, a_2, a_3, ..., a_N$ $(1 \leq a_i \leq 10^5)$.

Output

Output a single integer, th least number of unique integers after doing all the operations.

Examples

standard input	standard output
`3 1` `5 5 4`	`1`
`7 2` `4 3 1 1 3 3 2`	`2`

Problem J. Pricey Transportation

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Yellow`

Don has a meeting on the next Saturday in a co-working space. Sadly *Don* is on a budget, he can't afford high-priced transportation. *Don* decided to transport using buses.

After a lot of googling, *Don* discovered that there exist n bus stops where a_i represents the position of the i_{th} bus stop.

Given q queries, each query contains the starting position x and the maximum distance each bus can travel k, which means that the i_{th} bus can travel from a_i to $a_i + k$.

Help *Don* by finding out if it's possible to reach the co-working space at position a_n.

Note that if *Don* is currently in i_{th} bus, then he didn't need to end the whole trip, in other words, he can stop at any bus stop in the range $[a_i, a_i + k]$.

Input

The first line contains an integer n $(1 \le n \le 10^5)$ $-$ The number of bus stops.

The second line contains n integers a_i $(-10^9 \le a_i \le 10^9)$ $-$ The positions of the bus stops.

The third line contains an integer q $(1 \le q \le 10^5)$ $-$ The number of queries.

Each of the next q lines contains an integer x $(-10^9 \le x \le 10^9)$ and an integer k $(0 \le k \le 2 \times 10^9)$ $-$ The starting position and the maximum distance each bus can travel.

It is guaranteed that there exists a bus stop at position x.

It is guaranteed that the positions of the bus stops are given in non-decreasing order.

Output

Print "YES"if it's possible to reach a_n from x, otherwise, print "NO".

Example

standard input	standard output
6 -10 -3 -1 2 5 7 3 2 3 2 2 -3 3	YES NO YES

Note

In the first query, *Don* can take the bus from $x = 2$ to $x = 5$, then take another bus from $x = 5$ to $x = 7$.

In the second query, *Don* can take the bus from $x = 2$ but the furthest position he can reach from there is $x = 4$ and there isn't any buses he can take from there.

Problem K. Another Emergency Meeting

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Light green`

Another emergency meeting was called by one of the crewmates, asking for help with a certain task from his fellow crewmates. However, this task is much harder than the last one.

The task goes as follows: Given two permutations a and b of size n, you need to shuffle the two permutations in such a way that maximizes the result of the following equation: $\sum_{i=1}^{n} |a_i - b_i| * i$.

You – being one of the crewmates – could finish this task easily. Print the maximum value of the equation.

Since the answer may be large, print it modulo $10^9 + 7$.

Input

The first line contains a single integer t $(1 \le t \le 10^5)$ – the number of test cases.

Each of the following t lines contains an integer n $(1 \le n \le 10^9)$.

Output

Print one integer for each test case.

Example

standard input	standard output
3 1 2 4	0 3 24

Problem L. Bad Ziad

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Pink`

The year was 2012 when young *Ziad* went to the school to attend his math class. *Ziad* found that his math teacher had written n numbers on the board. When his teacher went outside the class, *Ziad* thought it would be fun to mess with his teacher by deleting some (or all) of the numbers on the board through a little game.

Ziad outlined the rules of the game as follows. Initially, he has a value sum initialized to 0.

- If there are no remaining numbers or the remaining numbers are all even or all odd, the game ends.
- He randomly chooses one even number and one odd number and adds their gcd (greatest common divisor) to the value sum.
- He removes the even and odd numbers he chose from the board.

After *Ziad* played the game, he was interested in the parity of the value sum after the game ended. He wondered whether the order of the numbers he removes affects the parity at the end. *Ziad* didn't know the answer (he was still young), so he asked his teacher. Although his teacher was mad at him for messing with the numbers, he forgave him as it was a good question and told him the answer.

Now *Ziad* will give you the n numbers written initially on the board and wants you to find the parity of the value sum at the end of the game.

Input

The first line in the input contains an integer n ($1 \le n \le 10^5$).

The second line contains n integers, $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 10^9$) — the numbers written on the board.

Output

Print `"Even"`(case insensitive) if the value sum is even at the end of the game, or `"Odd"`(case insensitive) if it is odd.

Example

standard input	standard output
2 1 2	Odd

Note

- $\gcd(x, y)$ is the greatest positive number that divides both x and y.
- Parity is the property of an integer of whether it is even or odd.

Problem M. Print Name

Input file: `standard input`
Output file: `standard output`
Balloon Color: `Black`

$Mostafa$ is a smart guy, he is new to programming, and his first programming language is $C++$,

His first program was how to print "Hello World" with code, and the second one was how to take input from the user, The user enters his *name* then the program prints "Hello *name*", $Mostafa$ thought that programming was very easy until his mentor $Hisham$ give him a challenging task to do,

$Hisham$ asked him to reverse his second program, in other words, the user enters "Hello *name*", and the program must print the *name* of the user. because $Mostafa$ is a beginner, he couldn't write this program, can you do that?

Input

The first line contains "Hello *name*", $(1 \leq |name| \leq 10^5)$ *name* contains only lowercase letters.

Output

Print the *name*.

Example

standard input	standard output
`Hello mostafa`	`mostafa`

Problem N. Ranch Or Barbecue?

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Silver`

No doubt, pizza is $Ziad's$ favorite food. However, he struggles with picking the perfect sauce for it. After a year of daily effort in picking the sauce of the pizza, $Ziad's$ friend $Zuqa$ was able to figure out a relation between the current day's sauce and the current day's number.

Let's define $GPF(x)$ as the greatest prime factor of an integer x, and the index of $GPF(x)$ as its 1-based index in the prime numbers. For example, $GPF(6) = 3$ and the index of 3 in the prime numbers is 2.

In $Bastardeeno$ city, where $Ziad$ currently lives, exists n numbers a_i $(0 \leq i < n)$ which the people of $Bastardeeno$ city cycle through. $Zuqa$ found out that on the i_{th} day, if the index of $GPF(a_{i\%n})$ is odd, then $Ziad's$ love for the ranch sauce increases by $GPF(a_{i\%n})$. Otherwise, $Ziad's$ love for the barbecue sauce increases by $GPF(a_{i\%n})$, where $a_{i\%n}$ is the i_{th} day number.

After the i_{th} day is done, $a_{i\%n}$ is divided by the $GPF(a_{i\%n})$ only if $GPF(a_{i\%n}) > 0$, where $GPF(0) = 0$ and $GPF(1) = 0$.

If on the i_{th} day $Ziad's$ love for the ranch sauce is greater than or equal to his love for the barbecue sauce, then he will pick the ranch sauce. Otherwise, he will pick the barbecue sauce.

$Ziad's$ love for both sauces starts from 0. For the next d days, help $Ziad$ determine which sauce he will pick for the i_{th} day.

Input

The first line contains 2 integers n $(1 \leq n \leq 10^5)$ and d $(1 \leq d \leq 3 \cdot 10^5)$ − the amount of numbers and the number of days.

The second line contains n integers $a_0, a_1, a_2, ..., a_{n-1}$ $(0 \leq a_i \leq 10^7)$ − the initial i_{th} day number.

Output

Print d lines. On the i_{th} line, if $Ziad's$ love for the ranch sauce is greater than or equal to his love for the barbecue sauce, print 'R'. Otherwise, print 'B'.

Example

standard input	standard output
5 7 1 9 4 5 7	R B B R B B B

Note

The indices of the days are 0-based.

Let r be Ziad's current love for the ranch sauce and b be Ziad's current love for the barbecue sauce.

In the first test case:

After the 1^{st} day, $r = 0$ and $b = 0$.

After the 2^{nd} day, $r = 0$ and $b = 3$.

After the 3^{rd} day, $r = 2$ and $b = 3$.

After the 4^{th} day, $r = 7$ and $b = 3$.

After the 5^{th} day, $r = 7$ and $b = 10$.

After the 6^{th} day, $r = 7$ and $b = 10$.

After the 7^{th} day, $r = 7$ and $b = 13$.