Problem A. Binary Friend

Input file:	`friend.in`
Output file:	`standard output`
Balloon Color:	`Gold`

Hemose was talking with his Syrian friend and he old him "*I love string problems very much*!!" so *Hemose* figured out some interesting task but *Hemose* thought it is very easy so instead of giving it to him, he decided to put it here in the contest.

Given a Binary String S of length n and an integer k, in one operation you can flip any character in S..i.e from 0 to 1 and vice versa.

let $C(t, S)$ is the number of occurrences of charcater t in S.

let's call a division of S good if

- S is divided into k parts..i.e $S = s_1 s_2 ... s_k$
- The ratio between the number of zero and the ones in every part is equal. ..i.e $C(0, s_1)/C(1, s_1) = C(0, s_2)/C(1, s_2) = ... = C(0, s_k)/C(1, s_k)$

A string a is a substring of a string b if a can be obtained from b by deletion of several (possibly, zero or all) characters from the beginning and several (possibly, zero or all) characters from the end.

A Binary String is a string of "0"s and "1"s only.

you have to do the minimum number of operations to get at least one good division of S.

Input

Each test contains multiple test cases. The first line contains the number of test cases T . Description of the test cases follows.

The first line of each testcase consists of two space-separated positive integers n and k ($1 \leq k \leq n \leq 1000$)

The second line of each test case contains a single binary string S of size n

it is guaranteed that the sum of n over all the cases ≤ 5000

Output

for each test case, one integer represents the minimum number of operations to have at least one good way to divide S.

Example

friend.in	standard output
2 3 2 101 4 2 0010	1 1

Problem B. Binary Abdouz

Input file:	abdouz.in
Output file:	standard output
Balloon Color:	Black

Abdouz is a famous Mathematician and he can solve any math problem so he decided to join the problem-solving community so he went to his friend *Hemose*, **As you know** *Hemose*, he decided to test his maths skills along with problem-solving skills so he gave him this task, can you help *Abdouz* to solve it?

Given a Binary String S of length n and an integer k. Can you divide S into k substrings such that the **Integer** values of all substrings are equal? Substrings could have **leading zeros**.

A string a is a substring of a string b if a can be obtained from b by deletion of several (possibly, zero or all) characters from the beginning and several (possibly, zero or all) characters from the end.

The **integer** value of binary string T is some integer X where The binary representation of X is equal to T without any leading zeros.

A Binary String is a string of "0"s and "1"s only.

Input

Each test contains multiple test cases. The first line contains the number of test cases T . Description of the test cases follows.

The first line of each testcase consists of two space-separated positive integers n and k ($1 \leq k \leq n \leq 10^5$)

The second line of each test case contains a single binary string S of size n

It is guaranteed that the sum of n over all test cases does not exceed $5 \cdot 10^5$

Output

for each test case, Print "YES"if you can divide the string and "NO"otherwise.

Example

abdouz.in	standard output
3 5 2 01001 14 3 01100101001001 12 3 101010101010	YES NO YES

Problem C. Old City

Input file:	`altstadt.in`
Output file:	`standard output`
Balloon Color:	`Light Green`

Ashraf and *Hemose* were walking in the **Old City** and because *Hemose* loves problem-solving *Ashraf* gave *Hemose* a problem which he can't solve. The problem says:-

Given an array of integers with even length n. He has to get the maximum result of the array using two operations:

1. Choose two elements and multiply them, remove them from the array, **add** the multiplication to the result.
2. Choose two elements and multiply them, remove them from the array, **subtract** the multiplication form the result.

He has to start with the first operation then the second and alternate between them until getting the array **empty**.

What is the maximum result he can achieve from the array using these operations?

Input

Each test contains multiple test cases. The first line contains the number of test cases T. Description of the test cases follows.

The first line of each test case consists of one positive integer n (the length of the array) ($2 \leq n \leq 500$)

The second line of each test case contains n integers a_i ($-10^7 \leq a_i \leq 10^7$).

It is guaranteed that the sum of n over all test cases does not exceed 2000

Output

For each test case print in separate lines, the maximum result after doing the operations and getting the array empty.

Example

altstadt.in	standard output
2 4 1 2 3 4 6 -5 -6 5 6 -7 -8	10 67

Problem D. Hosssam's Farm

Input file:	`farm.in`
Output file:	`standard output`
Balloon Color:	`Yellow`

Hosssam has a very big farm, The farm consists of **1 row** which has N plants. Since he is a lazy farmer he wanted to automate the irrigation process of the farm. He made a weird automated system which takes as an input a range of the farm (L, R) and for every continuous range that lies inside the given input (inclusive), The System drops one liter of water to each plant that lies inside that continuous range.

For example, if the farm has 3 plants and the system was given $(1, 3)$ as an input, for each of the following ranges $(1, 3), (1, 2), (1, 1), (2, 3), (2, 2), (3, 3)$ the system will drop one liter of water to each plant in that range. After the system is done the number of liters of water in each plant will be $[3, 4, 3]$.

Hosssam will need some statistics to improve the automated system, so he will be giving you Q queries where each query can be of two types

1. 1 L R, which means the automated system will be given (L, R) as an input.
2. 2 L R, which means Hosssam needs to know the total amount of water that was given to each plant in the range $[L, R]$ (inclusive)

for each query of the second type you will have to print the required sum modulo $(10^9 + 7)$.

Input

The first line of the input will contain N(the number of plants in the farm).

the next line contains Q(the number of queries).

the next Q lines contain one of the two types of the queries.

$1 \leq N \leq 100\,000$

$1 \leq Q \leq 100\,000$

$1 \leq L \leq R \leq N$

Output

For each query of the second type print the required sum , each on a new line.

Example

farm.in	standard output
3 4 1 1 3 2 1 1 2 1 2 2 1 3	3 7 10

Problem E. Thirsty Khater

Input file:	`vacation.in`
Output file:	`standard output`
Balloon Color:	`White`

Khater is traveling to an island to enjoy his summer vacation. He knows that there is no drinking water on this island. He will buy n bottles. He knows that the capacity of each bottle is k liters. He also knows that he will use 1 liter of water every day.

Khater wants to know how long he can stay on the island without being thirsty.

Input

The first line contains a single integer T denoting the number of test cases.

The first input line of each test case contains two integers n, k ($1 \leq n, k \leq 10^3$) — the number of bottles *Khater* will buy and the capacity of each bottle.

Output

For each test case, print a single integer d — the number of days he can stay on the island without being thirsty.

Example

vacation.in	standard output
2 3 4 7 1	12 7

Problem F. XOR

Input file:	`xor.in`
Output file:	`standard output`
Balloon Color:	`Dark Blue`

Bob doesn't like any problems related to XOR, So he gave you the following problem to solve instead of him.

You are given a String S which represents the binary representation of a number N.

You have to process the following queries

- 1 X means you will have to set N to be N multiplied by 2^X
- 2 X means you will have to set N to be N divided by 2^X **integer division**, $2^X \leq N$.
- 3 T means you will have to set N to be N bitwise or with T (T **will also be a binary string**).
- 4 K means you will have to get the **bitwise xor** of all the possible **subsequences** of the binary representation of N and print the $K-th$ bit from the right of the result.

All the binary strings in the input do not contain leading zeros.

A sequence a is a subsequence of a sequence b if a can be obtained from b by deletion of several (possibly, zero or all) elements.

Input

The first line of the input contains two integers n,q, the length of String S and the number of queries respectively.

The second line contains the string S, the binary representation of N.

The following q lines each contain a query to be performed.

$1 \leq n \leq 3 * 10^5$

$1 \leq q \leq 3 * 10^5$

$1 \leq X \leq 10^5$

$1 \leq K \leq size(N)$

$1 \leq sum(size(T)) \leq 3 * 10^5$

Output

for each query of type 4 output a single integer 0,1 the answer of it.

Example

xor.in	standard output
3 4 101 4 2 1 2 4 1 4 3	0 1 0

Problem G. Baby's Permutation

Input file:	`baby.in`
Output file:	`standard output`
Balloon Color:	`Silver`

Baby Hosssam was given a permutation for his birthday, He was very excited about the permutation so he decided that he is going to build a machine for his permutation.

The machine that he is going to build is going to take any permutation of size n as an input, and for each number k between 1 and n, the machine drops one coin if it can find any subsegment of the input permutation that is also a permutation of size k by using **at most 1 swap.**

For example, If the input was $(1, 2, 6, 5, 4, 3)$

When $k = 1$ the machine will drop a coin since the subsegment $[1, 1]$ is a permutation of size 1.

When $k = 2$ the machine will drop a coin since the subsegment $[1, 2]$ is a permutation of size 2.

When $k = 3$ the machine will drop a coin since we can swap 3 with 6 and the permutation becomes $(1, 2, 3, 5, 4, 6)$ hence the subsegment $[1, 3]$ becomes a permutation.

When $k = 4$ the machine will NOT drop a coin since we can't find any subsegment of size 4 using at most 1 swap.

When $k = 5$ the machine will drop a coin since we can swap 1 with 6 and the permutation becomes $(6, 2, 1, 5, 4, 3)$ hence the subsegment $[2, 6]$ becomes a permutation.

When $k = 6$ the machine will drop a coin since the subsegment $[1, 6]$ is a permutation of size 6.

Baby Hosssam wants to make sure that his machine is working so he will be giving you a permutation of size n and for each number k between 1 and n you will have to answer whether the machine will drop a coin or not.

Input

Each test contains multiple test cases. The first line contains the number of test cases T. Description of the test cases follows.

The first line of each test case consists of one positive integer n (the size of the permutation) $(1 \leq n \leq 10^5)$

The second line of each testcase contains n distinct numbers $(1 \leq p_i \leq n)$. Where p_i denotes the ith element in the permutation.

It is guaranteed that the sum of n over all test cases does not exceed $5 \cdot 10^5$.

Output

For each test case print, k space-separated strings.

For each k between 1 and n print "*opaLa*"if the machine is going to drop a coin, else print "*balabizo*"

Example

baby.in	standard output
1 6 1 2 6 5 4 3	opaLa opaLa opaLa balabizo opaLa opaLa

Problem H. Catwalk

Input file:	cat.in
Output file:	standard output
Balloon Color:	Dark Green

Sobhy loves strings, he keeps a lot of them in his room, an example of a string is "ifyouarereadingthisyouarewastingyourtime", Sobhy always shows his lovely collection of strings to his friends so they can appreciate the beauty.

When Sobhy's cat found about those strings, she started playing with them, in particular, she turned each string into a carpet so she can do a catwalk on it.

In the beginning, the cat is standing on the first character (index 0) of the string, each day the cat makes a forward jump, if the cat is on index i, it can jump to index j ($j > i$) if the substring [i... j-1] is palindromic, if there is more than one possible jump, the cat chooses one of them uniformly at random.

The walk ends when the cat reaches index n, which means the cat is now standing on the ground again.

The following are two possible catwalks on the string S = "aac":

- On the first day the cat jumps to index 2 (notice that the S[0..1] is palindromic), and on the second day the cat jumps from index 2 to index 3, the walk took 2 days to finish.
- On the first day the cat jumps to index 1, on the second day it jumps to index 2, and on the third day it jumps to index 3, taking 3 days to finish.

Now Sobhy is wondering if his cat walk on some string S, what is the expected number of days for it to finish the walk.

Input

The first line contains one integer T ($1 \le T \le 100$) — the number of test cases. Then T test cases follow.

Each test case consists of two lines, the first one is an integer n ($1 \le n \le 2 \cdot 10^5$), the length of the string S, and the second line contains a string of length n consisting of lowercase letters of the Latin alphabet.

The sum of lengths of all strings S in the test cases doesn't exceed $5 \cdot 10^5$.

Output

For each test case you should print a single line, which must contain the expected number of days taken by the cat to finish its walk on the string.

Your answer is considered correct if its absolute or relative error does not exceed 10^{-6}.

Formally, let your answer be a, and the jury's answer be b. Your answer is accepted if and only if $\frac{|a-b|}{\max(1,|b|)} \le 10^{-6}$.

Example

cat.in	standard output
4 3 aaa 5 abcde 1 z 3 aba	1.833333333 5.000000000 1.000000000 2.000000000

Problem I. Small But Huge

Input file:	`huge.in`
Output file:	`standard output`
Balloon Color:	`Pink`

Given an array of n numbers, Find the number of ways to cut the array into one or more subarrays such that the gcd of the product of numbers in every subarray is > 1, and print it mod $10^9 + 7$.

An array a is a subarray of an array b if a can be obtained from b by deletion of several (possibly, zero or all) elements from the beginning and several (possibly, zero or all) elements from the end.

Input

Each test contains multiple test cases. The first line contains the number of test cases T. Description of the test cases follows.

The first line of each test case consists of one positive integer n (the number of elements in the array) $(1 \leq n \leq 3 \cdot 10^5)$

The second line of each test case contains n numbers $(1 \leq a_i \leq 15)$. Where a_i denotes the ith element in the array.

It is guaranteed that the sum of n over all test cases does not exceed $5 \cdot 10^5$.

Output

For each test case print one integer in a separate line: the number of ways to cut the array into one or more subarrays such that the gcd of the product of numbers in every subarray is > 1, and print it *mod* $10^9 + 7$.

Example

huge.in	standard output
2 4 4 6 2 3 2 1 2	5 1

Problem J. Bakry and Array

Input file:	`good.in`
Output file:	`standard output`
Balloon Color:	`Orange`

Bakry has an array of length n where a_i denotes the value of $i-th$ element in the array.

Let's call pair (i, j) good if $i < j$ and $\gcd(a_i, a_j) = a_i | a_j$ where $|$ denotes the bitwise or operator.

Since Bakry is busy, Can you count the number of good pairs in the array?

Input

Each test contains multiple test cases. The first line contains the number of test cases T. Description of the test cases follows.

The first line of each test case consists of one positive integer n (the number of elements in the array) $(1 \leq n \leq 10^5)$

The second line of each test case contains n numbers $(1 \leq a_i \leq 10^5)$. Where a_i denotes the ith element in the array.

It is guaranteed that the sum of n over all test cases does not exceed $5 \cdot 10^5$.

Output

For each testcase print one integer: The number of good pairs in the array.

Example

good.in	standard output
2 2 1 2 6 2 4 6 3 2 3	0 2

Problem K. No XOR anymore !!!

Input file:	xmore.in
Output file:	standard output
Balloon Color:	Purple

Khater hates xor problems. So he created a new operator, He called it Xmore.

For two integers a, b the value of a Xmore b is the largest power of 2 which is less than or equal a xor b.

You will be given an array a of n integers of equal size, for q queries you are given 2 integers x, y. You are asked to answer with the value k where a_x Xmore $a_y = 2^k$.

Input

In the first line, you're given one integer n ($2 \leq n \leq 2 \cdot 10^6$), the number of integers in the array.

Each of the next n lines contains an integer a_i ($0 \leq |a_i| \leq 10^6$), The value of the i-th element in the **binary representation**

where $|a_i|$ is the length of the $i - th$ integer.

The next line contains a single integer q ($1 \leq q \leq 10^6$), The number of queries in the array.

Each of the next q lines contains two integer x, y ($1 \leq x, y \leq n, x \neq y$).

It's guaranteed that all numbers' length is equal in binary.

It's guaranteed that the summation of number sizes $\leq 2 \cdot 10^6$

Output

Print q lines: Each of the q lines contains a single integer — the answer of the i-th query.

for each query an integer x where 2^x is the answer or -1 if the answer is equal to 0.

Example

xmore.in	standard output
3 101 111 111 3 1 2 2 3 1 3	1 -1 1

Problem L. Leave Me Alone

Input file:	`alone.in`
Output file:	`standard output`
Balloon Color:	`Red`

Hosssam has a long ride from Aswan to Cairo, Since it is a long journey he likes to sit next to the window so that he can enjoy the views during the journey. Moreover, he doesn't like to sit next to someone as he wants to avoid any conversations during his journey.

The train has only one passenger's carriage, Also The train has a **zigzag** way of numbering the seats, for example if the train has 12 seats they will look like the following table

Window Seats	**Middle Seats**	**Space for walking**	**Window Seats**
seat 1	seat 2		seat 3
seat 6	seat 5		seat 4
seat 7	seat 8		seat 9
seat 12	seat 11		seat 10

In the previous example seats, 3,4,9, and 10 are the perfect seats for *Hosssam*.

you will be given Q queries where each query is a single-seat number.

your task is to determine for each given seat number whether it will be suitable for *Hosssam* or not.

Input

The first line contains Q (the number of queries). The next Q lines each contain a single number X the seat number.

$1 \leq Q \leq 10^3$

$1 \leq X \leq 10^9$

Output

For each seat number X , print in a separate line ":)"if the seat is suitable for Hosssam , otherwise print ":("

Example

alone.in	standard output
3 1 4 15	:(:) :)

Problem M. Is It Sorted?

Input file:	`store.in`
Output file:	`standard output`
Balloon Color:	`Light Blue`

Ashraf went to a store to buy some stuff and found n objects with different costs in a row to buy from.

He decides to buy the objects by choosing any two consecutive objects and buy the object with the **lower** cost and do that until the remaining objects are sorted in **ascending** order, he wants to buy the minimum number of objects.

Can you help and tell him the **minimum** number of objects he has to buy to make the remaining sorted?

Input

Each test contains multiple test cases. The first line contains the number of test cases T. Description of the test cases follows.

The first line of each test case consists of one positive integer n (the number of objects in the store) $(1 \leq n \leq 10^5)$

The second line of each test case contains n distinct costs of the objects c_i $(1 \leq c_i \leq 10^9)$.

It is guaranteed that the sum of n over all test cases does not exceed $5 \cdot 10^5$.

Output

For each test case print in separate lines, the minimum number of objects Ashraf has to buy.

Example

store.in	standard output
2 4 1 2 3 4 3 2 1 3	0 1