Problem A. Arrange and Count!

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	512 mebibytes

Alice has a sequence $a_1, a_2, \ldots, a_n$. She can rearrange the sequence using the following operation any number of times:

- Select an integer i $(1 \le i \le n)$ and change the sequence to $a_i, a_{i-1}, \ldots, a_1, a_n, a_{n-1}, \ldots, a_{i+1}$.

Alice would like to know the number of different sequences can be obtained modulo $(10^9 + 7)$.

Input

The input consists of several test cases terminated by end-of-file. For each test case:

The first line contains an integer n, the length of the sequence.

The second line contains n integers $a_1, a_2, \ldots, a_n$.

- $1 \le n \le 10^5$
- $1 \le a_i \le n$
- The sum of n does not exceed 2×10^6.

Output

For each test case, print an integer which denotes the result.

Example

standard input	standard output
4 1 1 1 1 4 1 1 2 2 4 1 2 1 2 4 2 1 2 1	1 4 2 2

Problem B. Build More 2020's!

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Byteazar got a string S $(s_1 \dots s_n)$ of length n consisting of only digits '0', '1', and '2', and he wants to pick some **disjoint** subsequences which equal to 2020, as many as possible.

Formally, Byteazar would like to find k quadruples $(a_1, b_1, c_1, d_1), \dots, (a_k, b_k, c_k, d_k)$ such as

- $1 \le a_i < b_i < c_i < d_i \le n$
- $s_{a_i} s_{b_i} s_{c_i} s_{d_i} = 2020$
- $\{a_i, b_i, c_i, d_i\} \cap \{a_j, b_j, c_j, d_j\} = \emptyset$ for $i \ne j$.

Find the maximum value of k.

Input

The input consists of several test cases terminated by end-of-file.

The first line of each test case contains an integer n $(1 \le n \le 10^5)$. Second line contains the string S $(s_1 \dots s_n)$. $(s_i \in \{0, 1, 2\})$. Sum of n in all test cases does not exceed 10^6.

Output

For each test case print an integer which denotes the result.

Examples

standard input	standard output
4 2222 7 2101210 9 122002200	0 1 2

Problem C. Choose Two Subsequences

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Clara has two strings s and t. She would like to choose two subsequences x from s and y from t such that:

- x is lexicographically smaller than or equal to y.
- The sum of $|x|$ and $|y|$ is maximal, where $|s|$ denotes the length of the string s.

Note that:

- Both x and y could be empty string.
- A subsequence is a sequence that can be derived from the given sequence by deleting zero or more elements without changing the order of the remaining elements.
- String x is lexicographically less than string y, if either x is a prefix of y (and $x \neq y$), or there exists such i ($1 \leq i \leq \min(|x|, |y|)$), that $x_i < y_i$, and for any j ($1 \leq j < i$) $x_j = y_j$.

Input

The input consists of several test cases terminated by end-of-file. For each test case:

The first line contains a string s. The second line contains a string t.

- $1 \leq |s| \leq 2000$
- $1 \leq |t| \leq 2000$
- The sum of $|s|$ does not exceed 20000.
- The sum of $|t|$ does not exceed 20000.
- Both the strings consist only of English lowercase letters.

Output

For each test case, output the sum of $|x|$ and $|y|$.

Example

standard input	standard output
aaaa bbbb abcd abca abcd abcd	8 7 8

Problem D. Determinant Strikes Back

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Dinara has an integer x and two n arrays $a_1, \ldots, a_n$, $b_1, \ldots, b_n$. She makes an $n \times n$ matrix M where

$$M_{i,j} = \begin{cases} x + a_i b_j & \text{when } i = j \\ a_i b_j & \text{otherwise} \end{cases}$$

Find the determinant of the matrix M modulo $(10^9 + 7)$.

Input

The input consists of several test cases terminated by end-of-file.

The first line of each test case contains two integers n and x. The second line contains n integers $a_1, \ldots, a_n$. The third line contains n integers $b_1, \ldots, b_n$.

- $1 \le n \le 10^5$
- $0 \le x, a_i, b_i \le 10^9$
- The sum of n does not exceed 10^6.

Output

For each test case, print an integer which denotes the result.

Examples

standard input	standard output
2 1 0 0 0 0 2 1 1000000000 1000000000 1000000000 1000000000 3 2 2 3 3 2 3 3	1 99 96

Problem E. Efficient Data Structure

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	512 mebibytes

Elly has two sequences $a_1, a_2, \ldots, a_n$ and $b_1, b_2, \ldots, b_n$. She would like to perform the following operations:

- `1` x y, change the value of a_x to y.
- `2` x y, change the value of b_x to y.
- `3` x, find the value of c_x, where $c_0 = 0$, $c_i = \max(c_{i-1} + b_i, a_i)$ for $1 \le i \le x$.

Implement an efficient data structure to process those operations.

Input

The input consists of several test cases terminated by end-of-file. For each test case:

The first line contains two integers n and m , which are the length of the two sequences and the number of operations. The second line contains n integers $a_1, a_2, \ldots, a_n$. The third line contains n integers $b_1, b_2, \ldots, b_n$. Each of the last m lines contains a query.

- $1 \le n, m \le 2 \times 10^5$
- $-10^9 \le a_i, b_i, y \le 10^9$
- $1 \le x \le n$
- The sum of n and the sum of m do not exceed 2×10^6.

Output

For each query of type 3, output an integer denoting the value of c_x.

Example

standard input	standard output
4 9 1 2 3 3 -1 2 3 3 3 1 3 2 3 3 3 4 2 2 -4 3 1 3 2 3 3 3 4	1 3 6 9 1 2 5 8

Problem H. Hamming Distance

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	512 mebibytes

Helena has generated a list of sequences:

$$\begin{aligned} S^1 &= [1] \\ S^2 &= S^1 + [2] + S^1 \\ S^3 &= S^2 + [3] + S^2 \\ &\dots \\ S^m &= S^{m-1} + [m] + S^{m-1} \end{aligned}$$

where $A + B$ means the concatenation of two sequences A and B.

For a given sequence $[a_1, a_2, \dots, a_n]$, let $f(i)$ be the Hamming distance between $[a_1, a_2, \dots, a_n]$ and $[S^m_i, S^m_{i+1}, \dots, S^m_{i+n-1}]$ $(1 \le i \le |S^m| - n + 1)$.

Helena would like to find the minimum value of $f(i)$ and the sum of $f(i)$ modulo $(10^9 + 7)$.

Note that the Hamming distance between two sequences of equal length is the number of positions at which the corresponding elements are different.

Input

The input consists of several test cases terminated by end-of-file.

The first line contains two integers n and m.

The second line contains n integers $a_1, a_2, \dots, a_n$.

- $1 \le m \le 10^5$
- $1 \le n \le \min(|S^m|, 10^5)$
- $1 \le a_i \le m$
- The sum of n does not exceed 2×10^6.

Output

For each test case, output two integers denoting the minimum value of $f(i)$ and the sum of $f(i)$ modulo $(10^9 + 7)$.

Example

standard input	standard output
3 3 1 2 3 3 3 1 1 1 3 3 1 2 1	1 9 1 7 0 7

Problem I. Integers and Ranges

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	512 mebibytes

Isaac has a decimal integer $\overline{a_1 a_2 \dots a_n}$, possibly with leading zeroes. He knows that for m ranges $[l_1, r_1], [l_2, r_2], \dots, [l_m, r_m]$, it holds that $a_{l_i} \times a_{l_i+1} \times \cdots \times a_{r_i} \bmod 9 = 0$. Find the number of valid integers $\overline{a_1 a_2 \dots a_n}$, modulo $(10^9 + 7)$.

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains two integers n and m.

The ith of the following m lines contains two integers l_i and r_i.

- $1 \le n, m \le 10^3$
- $1 \le l_i \le r_i \le n$
- There are at most 100 test cases.

Output

For each test case, print an integer which denotes the result.

Example

standard input	standard output
2 1 1 2 4 2 1 3 2 4 50 1 1 50	40 4528 100268660

Problem K. Autonomous Cities

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

There are N cities in Byteland, cities are connected by $N-1$ bidirectional roads such as each city can be reached from the another one using one of several those roads. A city is called *autonomous*, if it have only one road leading to (and from) this city.

Given N, find the least possible number of autonomous cities.

Input

Input consists of one integer N ($2 \le N \le 10^9$) — number of cities in Byteland.

Output

Print one integer — least possible number of autonomous cities.

Examples

standard input	standard output
2	2
3	2

Problem L. Customity

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Let's define *customity* of two adjacent elements a_i and a_{i+1} of the array A as $|a_i - a_{i+1}|$.

Given an integer array A. For one operation you may add to any element of the sequence arbitrary real number. Your task is to convert the array to one where maximum customity will be minimized.

Calculate minimal number of operations needed to do that.

Input

First line of the input contains one integer N — length of the given array ($2 \le N \le 10^5$). Second line contains N integers a_i ($-10^6 \le a_i \le 10^6$) — elements of the given array A.

Output

Print one integer — minimal number of operations needed to obtain the array where maximum customity is minimized.

Examples

standard input	standard output
2 1083 6006	1

Problem M. Interesting points

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Consider the plane with usual Cartesian coordinate system with center O $(0, 0)$.

Let's introduce polar coordinate system at the same plane. A point O is chosen as the pole and a positive ray of Ox is taken as the polar axis.

For a given angle α, there is a single line through the pole whose angle with the polar axis is α (measured counterclockwise from the axis to the line). Then there is a unique point on this line whose signed distance from the origin is r for given number r. For a given pair of coordinates (r, α) there is a single point, but any point is represented by many pairs of coordinates.

For example, (r, α), $(r, \alpha + 2\pi)$ and $(-r, \alpha + \pi)$ are all polar coordinates for the same point. The pole is represented by $(0, \alpha)$ for any value of α.

We will call the point *interesting*, if same pair of numbers is representing its Cartesian coordinates (x, y) and its polar coordinates (r, α). For given integer N count number of beautuful points (x, y) with the following property: $x + y$ is integer and $x + y \le N$.

Input

First line of the input contains one integer N — upper limit for $x + y$ $(0 \le N \le 10^9)$.

Output

If there are infinite number of such a points, print -1. Otherwise print one integer — answer to the problem.

Examples

standard input	standard output
0	1

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