# Codeforces Round #609 (Div. 1)

## A. Long Beautiful Integer

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given an integer $x$ of $n$ digits $a_1, a_2, \ldots, a_n$, which make up its decimal notation in order from left to right.

Also, you are given a positive integer $k < n$.

Let's call integer $b_1, b_2, \ldots, b_m$ **beautiful** if $b_i = b_{i+k}$ for each $i$, such that $1 \leq i \leq m - k$.

You need to find the smallest **beautiful** integer $y$, such that $y \geq x$.

### Input

The first line of input contains two integers $n, k$ ($2 \leq n \leq 200\,000, 1 \leq k < n$): the number of digits in $x$ and $k$.

The next line of input contains $n$ digits $a_1, a_2, \ldots, a_n$ ($a_1 \neq 0$, $0 \leq a_i \leq 9$): digits of $x$.

### Output

In the first line print one integer $m$: the number of digits in $y$.

In the next line print $m$ digits $b_1, b_2, \ldots, b_m$ ($b_1 \neq 0$, $0 \leq b_i \leq 9$): digits of $y$.

**Examples**

| input |
| --- |
| 3 2<br>353 |
| **output** |
| 3<br>353 |

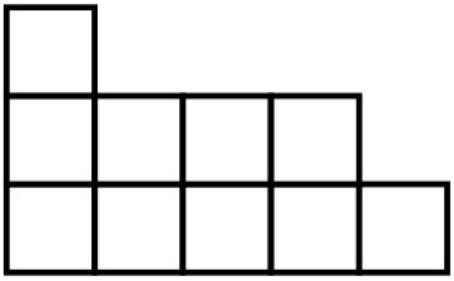
| input |
| --- |
| 4 2<br>1234 |
| **output** |
| 4<br>1313 |

## B. Domino for Young

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a Young diagram.

Given diagram is a histogram with $n$ columns of lengths $a_1, a_2, \ldots, a_n$ ($a_1 \geq a_2 \geq \ldots \geq a_n \geq 1$).



Young diagram for $a = [3, 2, 2, 2, 1]$.

Your goal is to find the largest number of non-overlapping dominos that you can draw inside of this histogram, a domino is a $1 \times 2$ or $2 \times 1$ rectangle.

### Input

The first line of input contain one integer $n$ ($1 \leq n \leq 300\,000$): the number of columns in the given histogram.

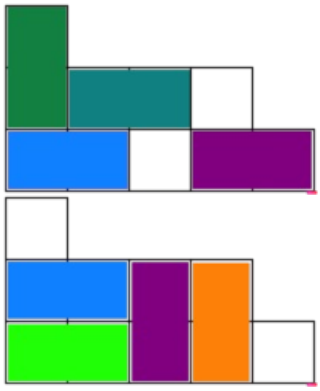
The next line of input contains $n$ integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 300\,000, a_i \ge a_{i+1}$): the lengths of columns.

### Output
Output one integer: the largest number of non-overlapping dominos that you can draw inside of the given Young diagram.

#### Example

| input |
| --- |
| 5<br>3 2 2 2 1 |
| **output** |
| 4 |

### Note
Some of the possible solutions for the example:



## C. K Integers

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a permutation $p_1, p_2, \ldots, p_n$.

In one move you can swap two adjacent values.

You want to perform a minimum number of moves, such that in the end there will exist a subsegment $1, 2, \ldots, k$, in other words in the end there should be an integer $i$, $1 \le i \le n - k + 1$ such that $p_i = 1, p_{i+1} = 2, \ldots, p_{i+k-1} = k$.

Let $f(k)$ be the minimum number of moves that you need to make a subsegment with values $1, 2, \ldots, k$ appear in the permutation.

You need to find $f(1), f(2), \ldots, f(n)$.

### Input
The first line of input contains one integer $n$ ($1 \le n \le 200\,000$): the number of elements in the permutation.

The next line of input contains $n$ integers $p_1, p_2, \ldots, p_n$: given permutation ($1 \le p_i \le n$).

### Output
Print $n$ integers, the minimum number of moves that you need to make a subsegment with values $1, 2, \ldots, k$ appear in the permutation, for $k = 1, 2, \ldots, n$.

#### Examples

| input |
| --- |
| 5<br>5 4 3 2 1 |
| **output** |
| 0 1 3 6 10 |

| input |
| --- |
| 3<br>1 2 3 |
| **output** |
| 0 0 0 |

## D. Invertation in Tournament

time limit per test: 3 seconds

memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a tournament — complete directed graph.

In one operation you can pick any vertex $v$ and change the direction of all edges with $v$ on one of the ends (i.e all edges $u \to v$ change their orientation to $v \to u$ and vice versa).

You want to make the tournament strongly connected with the smallest possible number of such operations if it is possible.

Also, if it is possible, you need to find the number of ways to make this number of operations to make graph strongly connected (two ways are different if for some $i$ vertex that we chose on $i$-th operation in one way is different from vertex that we chose on $i$-th operation in another way). You only need to find this value modulo $998\,244\,353$.

### Input
The first line of input contains one integer $n$ ($3 \le n \le 2000$): the number of vertices in the tournament.

Following $n$ lines contain a description of the given tournament, each of them contains a binary string of length $n$. If $j$-th character of $i$-th string is equal to '1', then the graph has an edge $i \to j$.

It is guaranteed that there are no edges $i \to i$ and the graph has **exactly one** edge among $i \to j$ and $j \to i$ for different $i$ and $j$.

### Output
If it is not possible to convert tournament to strongly connected with the given operations, output "-1".

Otherwise, output two integers: the smallest number of operations that you need to make the given graph strongly connected and the number of ways to do this number of operations to make graph strongly connected, modulo $998\,244\,353$.

**Examples**

| input |
| --- |
| 3<br>010<br>001<br>100 |
| **output** |
| 0 1 |

| input |
| --- |
| 4<br>0010<br>1000<br>0100<br>1110 |
| **output** |
| -1 |

| input |
| --- |
| 6<br>010000<br>001000<br>100000<br>111001<br>111100<br>111010 |
| **output** |
| 2 18 |

## E. Happy Cactus

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

You are given a cactus graph, in this graph each edge lies on at most one simple cycle.

It is given as $m$ edges $a_i, b_i$, weight of $i$-th edge is $i$.

Let's call a path in cactus **increasing** if the weights of edges on this path are increasing.

Let's call a pair of vertices $(u, v)$ **happy** if there exists an increasing path that starts in $u$ and ends in $v$.

For each vertex $u$ find the number of other vertices $v$, such that pair $(u, v)$ is happy.

### Input

The first line of input contains two integers $n, m$ ($1 \leq n, m \leq 500\,000$): the number of vertices and edges in the given cactus.

The next $m$ lines contain a description of cactus edges, $i$-th of them contain two integers $a_i, b_i$ ($1 \leq a_i, b_i \leq n, a_i \neq b_i$).

It is guaranteed that there are no multiple edges and the graph is connected.

## Output

Print $n$ integers, required values for vertices $1, 2, \ldots, n$.

### Examples

| input |
| --- |
| 3 3<br>1 2<br>2 3<br>3 1 |
| **output** |
| 2 2 2 |

| input |
| --- |
| 5 4<br>1 2<br>2 3<br>3 4<br>4 5 |
| **output** |
| 4 4 3 2 1 |