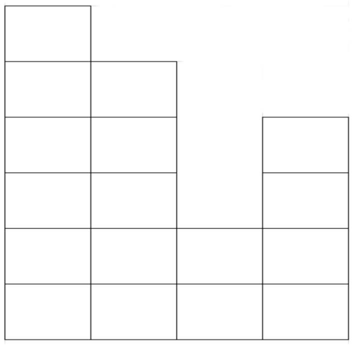
Problem A. Columns

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 MB

Sonya's little friend Yanyk came to visit her. He brought his cubes to play with Sonya and build a castle. While they were building it, Sonya, who is creative girl, invented her own game with cubes.

Let's assume that we have n columns of cubes, i-th is of height a_i. We need to find minimal number of colors we require to color all cubes in such a way that all subrows and all columns contain cubes of different colors. Subrow is a horisontal sequence of cubes that are located sequentially in one row.



Input

The first line contains integer n ($1 \leq n \leq 1000$) — number of columns.

The second line contains n integers a_i ($1 \leq a_i \leq 1000$) — height of i-th column.

Output

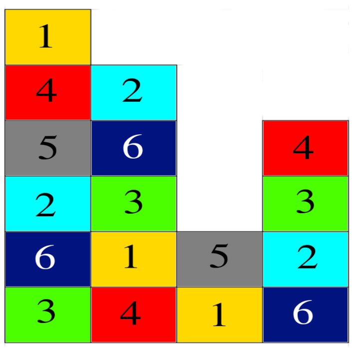
Print one integer — minimal number of colors necessary to paint all cubes in the way that all subrows and columns contain different colors.

Example

standard input	standard output
4 6 5 2 4	6

Note

One of possible solutions:



Note, that the third row from bottom contains two cubes of same color, it can happen if there is an empty place between them (the third column is of height 2 only).

Problem B. Competition

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 MB

New year on schools brought brought new assignments to pupils... Sonya is not an exception. She just entered school building, and already got a task to organize volleyball tournament. Rules say that at each round twi people are selected to compete. The one who lost leaves the competition. As soon as Sonya knows some participants, she can forecast who will win in particular pair. She knows who will win in m pairs.

If she does not know about who will win in some pair, anyone can will. Competition continues until only one person remains — the winner. Find out who can win!

Input

The first line contains two numbers n and m ($1 \le n \le 10^5$, $0 \le m \le 3 \times 10^5$) — number of people and pairs, for which we know who will win.

Each of the following m lines contains two numbers a and b ($1 \le a, b \le n$, $a \ne b$) — contestant with number a will defeat b, if they will compete.

It is guaranteed that if pair (a, b) appeared at input, no pairs (a, b) or (b, a) will appear again.

Output

The first line contains number of contestants that can win.

The second line should contain then in ascending order.

Example

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

Note

The first contestant can't win since we know that all other contestants defeat him.

The second contestant can't win since while he can defeat the first one, he will lose to the third and the fourth.

We do not know how the third against the fourth contestants will play, each of them can win.

Problem C. Relay

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 MB

As soon as Sonya was successful in organizing volleyball tournament and it was appreciated by teachers, all people understood that organizing is her passion.

In a week she got another task — conduct a relay for novice pupils. We know that pupils will be split into teams of boys and girls and that each team should have **same number of contestants**. The main thing — she needs to determine level of success for this event.

Level of success is a maximum number of participants in one of the teams.

Sonya wants to determine level of success for the event and switch to solving of programming tasks, so asks you about help.

Input

The first line at input contains one integer n $(1 \leq n \leq 100)$ — the number of novice pupils.

The following line contains n integers a_i $(1 \leq a_i \leq 2)$ — 1, if i-th pupil is a boy or 2, if she is a girl.

Output

Print one integer — the maximum level of success.

Examples

standard input	standard output
7 1 2 2 2 1 1 2	3
8 1 1 1 1 2 2 1 1	2

Note

In the first sample we can invite to the team of boys the first, the fifth and the sixth pupils, to the team of girls the second, the fourth and the seventh pupils, while the third can substitute any of them.

In the second sample the boys team can consist of the first and the third, while instead of them anyone of four can be, and the girls team can contain the fifth and the sixth.

Problem D. Strings

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 second
Memory limit:	256 MB

We have a string s of length n containing symbols '`0`' and '`1`'.

You can execute function $f(l, r, c)$, where $1 \le l < r \le |s|$ ($|s|$ — length of the string s) and substring $[l, r]$ contains at least one symbol c. This function replaces whole substring with one symbol c. If, for example, $s = 11010$, and we execute $f(2, 5, 0)$, we will get the string 10.

You need to count how many strings can be obtained. Strings are different if sequences of function executions to obtain them are different.

Since answer can be very large, you need to find it by modulo $10^9 + 7$.

Input

The only line contains n ($1 \le n \le 50$) symbols of '`0`' and '`1`'.

Output

Print result by modulo $10^9 + 7$.

Examples

standard input	standard output
`111`	`6`
`101`	`13`

Note

In the first example for the string 111 (1).

- $f(1, 2, 1) \Rightarrow 11$ (2).
  - $f(1, 2, 1) \Rightarrow 1$ (3).
- $f(2, 3, 1) \Rightarrow 11$ (4).
  - $f(1, 2, 1) \Rightarrow 1$ (5).
- $f(1, 3, 1) \Rightarrow 1$ (6).

In the second example for the string 101 (1).

- $f(1, 2, 1) \Rightarrow 11$ (2).
  - $f(1, 2, 1) \Rightarrow 1$ (3).
- $f(1, 2, 0) \Rightarrow 01$ (4).
  - $f(1, 2, 1) \Rightarrow 1$ (5).
  - $f(1, 2, 0) \Rightarrow 0$ (6).
- $f(2, 3, 0) \Rightarrow 10$ (7).
  - $f(1, 2, 1) \Rightarrow 1$ (8).
  - $f(1, 2, 0) \Rightarrow 0$ (9).

- $f(2, 3, 1) \Rightarrow 11$ (10).
  - $f(1, 2, 1) \Rightarrow 1$ (11).
- $f(1, 3, 1) \Rightarrow 1$ (12).
- $f(1, 3, 0) \Rightarrow 0$ (13).

Problem E. Polygon

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	256 MB

Sonya is a very smart girl and she likes to solve non standard tasks and puzzles. Looking for tasks in internet she have found many repeating ones, but she found one task she liked.

She has a table $n \times m$ containing lowercase roman letters.

Each sell is a square of same size. Corners of this table have their coordinates. Left top corner has coordinates (0, 0), right top — (n, 0), left bottom — (0, m), right bottom — (n, m).

You need to find all polygons satisfying:

1. its corners are in this table;
2. its edges are parallel to the coordinate axes;
3. all cells, that are inside the polygon, contain same letter.

She already has a polygon that satisfies first two conditions. It's allowed to move it in any of four directions, and its not allowed to rotate it.

Help Sonya find number of polygons that satisfy all conditions.

Input

The first line contains two integers n and m ($1 \leq n, m \leq 500$) — dimensions of the table.

The following n lines contain m roman lowercase letters.

The next line contains integer t ($4 \leq t \leq 500$) — number of vertices in the polygon.

And the following t lines contain two integers each — x_i and y_i ($0 \leq x_i \leq n, 0 \leq y_i \leq m$), coordinates of vertices. Vertices are listed clockwise.

You can assume that first two conditions are satisfied by the polygon.

Output

Print one number — answer for the task.

Example

standard input	standard output
3 4 zzzq zzzq zzqq 4 2 0 2 2 0 2 0 0	3

Note

A polygon in the example — square 2×2, the third condition will be satisfied if left top corner will have coordinates $(0, 0)$, $(0, 1)$, or $(1, 0)$.

Problem F. GCD

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	256 MB

Find

$$\sum_{a=l_1}^{r_1} \sum_{b=l_2}^{r_2} gcd(a, b)$$

where $gcd(a, b)$ — greatest common divider of a and b.

Since this number can be very large, print it by modulo $10^9 + 7$.

Input

The first line contains two integers l_1 and r_1 ($1 \le l_1 \le r_1 \le 5 \times 10^6$).

The second line contains two integers l_2 and r_2 ($1 \le l_2 \le r_2 \le 5 \times 10^6$).

Output

Print one integer — sum by modulo $10^9 + 7$.

Example

standard input	standard output
3 5 5 8	22

Note

Table of greatest common dividers for numbers $[3 - 5]$ and $[5 - 8]$.

```
X 5 6 7 8

3 1 3 1 1

4 1 2 1 4

5 5 1 1 1
```

If we sum up all these numbers, we get 22.

Problem G. Grid

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 MB

We have a grid $n \times m$, which contains numbers a_{ij} from 0 to 10^6.

You need to replace each 0 with some number from range 1 to 10^6 in the way that maximum difference between any two adjacent numbers is minimal. You can't change positive numbers.

The numbers are adjacent if cells they belong to have common edge.

Input

The first line contains two integers n and m ($1 \le n, m \le 1000$) — grid dimentions.

Each of following n lines contain m integers a_{ij} ($0 \le a_{ij} \le 10^6$) — numbers in the grid.

Output

In n lines print m numbers b_{ij} ($1 \le b_{ij} \le 10^6$) in each, and if $a_{ij} > 0$, b_{ij} should be equal to a_{ij}.

If several solutions are possible, print any of them.

Examples

standard input	standard output
3 2 0 5 0 0 0 3	5 5 4 4 3 3
3 5 0 4 2 0 0 0 0 0 0 0 0 0 0 0 3	4 4 2 3 3 4 4 2 2 3 4 4 2 3 3

Note

In the first example maximum difference between adjacent numbers is 1, and we can't get 0.

In the second example we cant get maximum difference less than 2, since we have adjacent two and four fixed.

Problem H. BW

Input file: `standard input`
Output file: `standard output`
Time limit: 1 second
Memory limit: 256 MB

We have a grid $n \times m$, each cell is either white or black.

You can change cell's color. If you change color of cell (x, y), that will also check color of all neighboring cells of same colors, color of their neighbors and so forth. I other words, you change color of whole component of one color.

Cells are neighboring if they have common edge.

You need to find minimal number of changes necessary to make all cells colored in same color.

Input

The first line contains two integers n and m $(1 \le n, m \le 75)$ — dimensions of the grid.

Each of the following n lines contains m symbols c_{ij} $(0 \le c_{ij} \le 1)$, if $c_{ij} = 0$, cell (i, j) is white, otherwise (`1`) it is black.

It is guaranteed that you need not more than `500` changes.

Output

GThe first line should contain t $(0 \le t \le 500)$ — minimal number of required chganges.

Each of the following t lines should contain two integers x_i та y_i $(1 \le x_i \le n, 1 \le y_i \le m)$ — coordinates of the cell to change it's color.

If several answers are possible, print any of them.

If you get `Presentation Error`, you violated output rules.

If you get `Wrong Answer`, then after all changes grid contains several colors, or number if changes is nit minimal.

Example

standard input	standard output
4 5 01001 01111 00011 10111	2 1 3 3 2

Note

In the example you can change color in white zones, they will change to black and whole grid will become black.

Problem I. Ones

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 MB

Today is the great day for the world of programming contests, today is the day of AUCPC. Since Sonya and her team plans to participate in it, they should practice a lot. They have learned many algorithms, have already solved a lot of problems, and advise you, as their friends, to solve one of them:

Count how many string of length n, which contain zeroes and ones and do not contain two zeroes in a row, exist.

Sonya does not want to work with long integers, you need to print your answer modulo $10^9 + 7$.

Input

Single line contains one integer n ($1 \le n \le 10^5$) — length of a string.

Output

Print result modulo $10^9 + 7$.

Examples

standard input	standard output
2	3
3	5

Note

In the first example corresponding strings are `00`, `01`, and `10`.

In the second example corresponding strings are `000`, `001`, `010`, `100`, and `101`.

Problem J. MST

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 MB

You have a tree with n nodes, each edge has assigned weight. You need to find minimal «weight» of full graph, where all edges have integer weight and where the only minimal spanning tree is the tree you have.

Weight of a graph — sum of weights of all edges.

Full graph — praph, where each pair of vertices is connected with an edge.

Minimal spanning tree — tree inside a graph, that connects all vertices and has minimal weight.

Input

The first line contains one number n ($1 \le n \le 2 \times 10^5$) — number of vertices in the treei.

Each of foolowing $n - 1$ lines contain three number a, b, and c ($1 \le a, b \le n$, $a \ne b$, $1 \le c \le 10^6$) — vertices, connected with an edge and it's weight.

Guaranteed, that graph at input is a tree.

Output

Print one number — minimal weight of full graph.

Examples

standard input	standard output
4 1 2 3 2 4 2 3 2 4	23
3 1 3 2 2 3 1	6

Note

In the first example you can add an edges connecting vertices 1 and 3 with weight 5, 1 and 4 with weight 4, 3 and 4 with weight 5. Will get $3 + 2 + 4 + 5 + 4 + 5 = 23$.

In the second example we can add an edge between 1 and 2 with weight 3. Will get $1 + 2 + 3 = 6$.

Problem K. Bits

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 MB

Sonya has day off todays and she decided to visit her best friend in Santa Monica. Flying there from New York takes time, 5 hours... She read a book, listened to a music, and finally decided to play a game on her iPhone X. Game is very interesting, time flew very fast, so she advises you to play this game when you are flying!

You have n integers, written in binary form, that is using zeroes and ones. You need to change as little bits as possible to obtain numbers written in dictionary order.

String a precedes string b of the same length in dictionary if there exists t, such that $a_1 = b_1$, $a_2 = b_2$, $\cdots$, $a_{t-1} = b_{t-1}$, та $a_t < b_t$.

Several equal strings can follow each other.

Input

The first line contains two numbers n and m ($1 \le n \le 200$, $1 \le m \le 16$) — number of integers and number of bits in each correspondingly.

Each of following n lines contains exactly m bits.

Output

Print one integer — minimal number of bits that you need to change.

Examples

standard input	standard output
4 5 11111 10100 01101 11011	3
2 3 111 011	1

Note

In the first string of the first example we change leftmost bit. In the third — two leftmost bits.

We get:

```
01111
10100
10101
11011
```

In the second example it's enough to change leftmost bit in any row.

Problem L. Array

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 MB

Tomorrow in the school where Sonya is studying pupils will teach their classmates. Since she loves programming a lot, she wants to teach this subject. Sonya is to prepare a lecture and contest with original problems. One of them she proposes you to solve.

You have an array a of size n. You can do following operation with it:

Select two numbers x and y in the array and **prime** integer k, which is divider of x. After that you remove number x and add $\frac{x}{k}$, also you remove y and add $y \times k$.

You need to change the array in a way, that greatest common divider of all numbers is maximal.

Find this greatest common divider and minimal number of actions that should be performed to get this array.

Input

The first line contains integer n $(1 \leq n \leq 100)$ — size of the array.

The second line contains n integers a_i $(1 \leq a_i \leq 10^6)$ — numbers in the array.

Output

Print two integers — maximal greatest common divider, that can be obtained, and minimal number of actions required to get necessary array.

Examples

standard input	standard output
3 1 3 9	3 1
3 24 9 16	12 3

Note

In the first example you can divide 9 by 3 and multiply 1 by 3, you will get $[3, 3, 3]$, greatest common divider for this array is 3.

In the second example you need to divide 9 by 3 and multiply 16 by 3, you will get $[24, 3, 48]$, also the last number should be divided twice by 2, multiplying the second, you will get $[24, 12, 12]$, greatest common divider is 12.