Problem Set 4
15-295 Spring 2020

A. Basketball Exercise

time limit per test: 2 seconds
memory limit per test: 256 megabytes

Dynamic Programming

Finally, a basketball court has been opened in SIS, so Demid has decided to hold a basketball exercise session. $2 \cdot n$ students have come to Demid's exercise session, and he lined up them into two rows of the same size (there are exactly n people in each row). Students are numbered from 1 to n in each row in order from left to right.
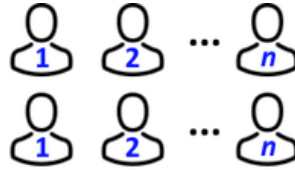
Now Demid wants to choose a team to play basketball. He will choose players from left to right, and the index of each chosen player (excluding the first one **taken**) will be strictly greater than the index of the previously chosen player. To avoid giving preference to one of the rows, Demid chooses students in such a way that no consecutive chosen students belong to the same row. The first student can be chosen among all $2n$ students (there are no additional constraints), and a team can consist of any number of students.

Demid thinks, that in order to compose a perfect team, he should choose students in such a way, that the total height of all chosen students is maximum possible. Help Demid to find the maximum possible total height of players in a team he can choose.

Input

The first line of the input contains a single integer n ($1 \leq n \leq 10^5$) — the number of students in each row.

The second line of the input contains n integers $h_{1,1}, h_{1,2}, \ldots, h_{1,n}$ ($1 \leq h_{1,i} \leq 10^9$), where $h_{1,i}$ is the height of the i-th student in the first row.

The third line of the input contains n integers $h_{2,1}, h_{2,2}, \ldots, h_{2,n}$ ($1 \leq h_{2,i} \leq 10^9$), where $h_{2,i}$ is the height of the i-th student in the second row.
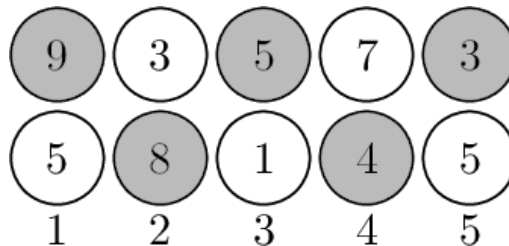
Output

Print a single integer — the maximum possible total height of players in a team Demid can choose.

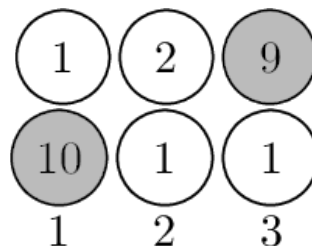### Examples

input	output
5 9 3 5 7 3 5 8 1 4 5	29

input	output
3 1 2 9 10 1 1	19

input	output
1 7 4	7

Note

In the first example Demid can choose the following team as follows:

In the second example Demid can choose the following team as follows:

B. Vacations

Vasya has n days of vacations! So he decided to improve his IT skills and do sport. Vasya knows the following information about each of this n days: whether that gym opened and whether a contest was carried out in the Internet on that day. For the i-th day there are four options:

1. on this day the gym is closed and the contest is not carried out;
2. on this day the gym is closed and the contest is carried out;
3. on this day the gym is open and the contest is not carried out;
4. on this day the gym is open and the contest is carried out.

On each of days Vasya can either have a rest or write the contest (if it is carried out on this day), or do sport (if the gym is open on this day).

Find the minimum number of days on which Vasya will have a rest (it means, he will not do sport and write the contest at the same time). The only limitation that Vasya has — *he does not want to do the same activity on two consecutive days: it means, he will not do sport on two consecutive days, and write the contest on two consecutive days*.

Input

The first line contains a positive integer n ($1 \le n \le 100$) — the number of days of Vasya's vacations.

The second line contains the sequence of integers $a_1, a_2, ..., a_n$ ($0 \le a_i \le 3$) separated by space, where:

- a_i equals 0, if on the i-th day of vacations the gym is closed and the contest is not carried out;
- a_i equals 1, if on the i-th day of vacations the gym is closed, but the contest is carried out;
- a_i equals 2, if on the i-th day of vacations the gym is open and the contest is not carried out;
- a_i equals 3, if on the i-th day of vacations the gym is open and the contest is carried out.

Output

Print the minimum possible number of days on which Vasya will have a rest. Remember that Vasya refuses:

- to do sport on any two consecutive days,
- to write the contest on any two consecutive days.

Examples

input
4 1 3 2 0

output
2

input
7 1 3 3 2 1 2 3

output
0

input
2 2 2

output
1

Note

In the first test Vasya can write the contest on the day number 1 and do sport on the day number 3. Thus, he will have a rest for only 2 days.

In the second test Vasya should write contests on days number 1, 3, 5 and 7, in other days do sport. Thus, he will not have a rest for a single day.

In the third test Vasya can do sport either on a day number 1 or number 2. He can not do sport in two days, because it will be contrary to the his limitation. Thus, he will have a rest for only one day.

C. Game of numbers

— It' s a good game, — Princess said pensively. It was clear that she was thinking about something else.

— They like to play various games here in Castles Valley. And they invent ones themselves. Say, my friend Knight played with a princess a game some time ago, — Dragon thought it was a good idea o tell Princess about another game, if, perhaps, previous game was seemed no interesting for her.

Princess A. offered Knight to play a game of numbers. She puts down the number zero on a sheet of paper. Let us call this number a *current result*.

Further steps of princess A. and Knight are described below. She calls any positive integer and Knight says what she must do with this number: to add it to the current result or subtract it from the current result.

Princess A. performs the action and calculates a new value. This value becomes the new current result.

Princess A. wants that current result to be not less than zero and not greater than k at any time. The game finishes when an action makes the result out of the range or when a sequence of n numbers, which princess A. conceived, exhausts.

Knight managed to learn the sequence of n numbers that princess A. guessed, and now he wants the game to last as long as possible.

Your task is to compute maximum possible number of actions which Knight is able to perform during the game.

Input

The first line contains integers n and k ($1 \leq n \leq 1000, \ 1 \leq k \leq 1000$) — the size of sequence which princess A. conceived and an upper bound for a current result which must not be exceeded.

The second line contains n integers $c_1, c_2, ..., c_n$ ($1 \leq c_j \leq k$) — the sequence which princess A. conceived.

Output

In the first line print integer d — maximum possible number of actions, which Knight is able to perform during the game.

Print d symbols "+" and "-" in the second line. Symbol at jth position specifies an action which is applied to jth number in the princess' sequence. If multiple answers exist, choose any of them.

Examples

input	output
2 5 3 2	2 ++

input	output
5 5 1 2 3 4 5	4 ++-+

D. Whose product? How many?

Given $1 \leq n \leq 50$ and $0 \leq k \leq 10^9$. Among all integers with n digits, count the number of integers whose product of all digits is exactly k. Note that leading zero is allowed here, but for this case the product of all digits will always be 0.

Input

A single line contains two integers n and k.

Output

A single line contains a single integer which is the answer. Since the answer may be large, display it modulo $1,000,000,007$

Examples

input	output
2 3	2

input	output
2 0	19

E. Teleport Stations

Given $a_1, a_2, \ldots, a_n$ and an integer $k \geq 0$. Initially we are at a_1. We want to first go to a_2, then to a_3, ..., and finally to a_n. Going from x to y costs $|x - y|$. We can build k extra teleport stations. Going from one teleport station to the other has no cost. Minimize total costs.

Input

The first line contains a single integer $2 \leq n \leq 50$. Each of the n following lines contains an integer a_i, whose absolute value is at most 10^9. The last line contains a single integer $0 \leq k \leq 50$.

Output

The minimum total cost.

Example

input	output
4 0 6 8 2 2	6

Note

For the example, we build two teleport stations at location 1 and 7. The route will be $0 \rightarrow 1 \rightarrow 7 \rightarrow 6 \rightarrow 8 \rightarrow 7 \rightarrow 1 \rightarrow 2$. Total cost will be $1 + 1 + 2 + 1 + 1 = 6$.

F. Simba on the Circle

time limit per test: 1 second
memory limit per test: 256 megabytes

You are given a circular array with n elements. The elements are numbered from some element with values from 1 to n in clockwise order. The i-th cell contains the value a_i. The robot Simba is in cell s.

Each moment of time the robot is in some of the n cells (at the begin he is in s). In one turn the robot can write out the number written in current cell or move to the adjacent cell in clockwise or counterclockwise direction. To write out the number from the cell Simba doesn't spend any time, but to move to adjacent cell Simba spends one unit of time.

Simba wants to write the number from each cell one time, so the numbers will be written in a non decreasing order. Find the least number of time units to write out all numbers.

Input

The first line contains two integers n and s ($1 \le s \le n \le 2000$) — the number of cells in the circular array and the starting position of Simba.

The second line contains n integers a_i ($-10^9 \le a_i \le 10^9$) — the number written in the i-th cell. The numbers are given for cells in order from 1 to n. Some of numbers a_i can be equal.

Output

In the first line print the number t — the least number of time units.

Each of the next n lines should contain the direction of robot movement and the number of cells to move in that direction. After that movement the robot writes out the number from the cell in which it turns out. The direction and the number of cells should be printed in the form of +x in case of clockwise movement and - x in case of counterclockwise movement to x cells ($0 \le x \le n - 1$).

Note that the sum of absolute values of x should be equal to t.

Examples

input	output
9 1 0 1 2 2 2 1 0 1 1	12 +0 -3 -1 +2 +1 +2 +1 +1 +1

input	output
8 1 0 1 0 1 0 1 0 1	13 +0 +2 +2 +2 -1 +2 +2 +2

input	output
8 1 1 2 3 4 5 6 7 8	7 +0 +1 +1 +1 +1 +1 +1 +1

input	output
8 1 0 0 0 0 0 0 0	7 +0 +1 +1 +1 +1 +1 +1 +1