A - Add and Swap

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 600 points

Problem Statement

You are given integers N, K, and a sequence $A = (A_1, \ldots, A_N)$ of length N.

Determine whether it is possible to make A non-decreasing by performing the following operation at most 500000 times, and if possible, provide one sequence of operations to do so.

- Choose an integer i between 1 and $N-1$, inclusive. Simultaneously replace A_i with $A_{i+1} + K$, and A_{i+1} with A_i.

Constraints

- All input numbers are integers.
- $2 \leq N \leq 50$
- $1 \leq K \leq 50$
- $1 \leq A_i \leq 50$

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \quad K \\
A_1 \quad \ldots \quad A_N
\end{array}
$$

Output

If it is impossible to make A non-decreasing within 500000 operations, print `No`. Otherwise, print a solution in the following format, where M is the number of operations $(0 \leq M \leq 500000)$, and i_k is the i chosen in the k-th operation $(1 \leq k \leq M)$:

```
Yes
M
i_1 ... i_M
```

If multiple valid solutions exist, any of them will be considered correct.

Sample Input 1

```
3 2
3 6 4
```

Sample Output 1

```
Yes
1
2
```

Let us perform the operation with $i = 2$. This simultaneously replaces A_2 with $A_3 + 2 = 6$, and A_3 with $A_2 = 6$, making $A = (3, 6, 6)$.

Now A is non-decreasing, so this output satisfies the conditions.

Sample Input 2

```
3 3
1 5 8
```

Sample Output 2

```
Yes
2
2 2
```

It is not necessary to minimize the number of operations.

B - Sum of CC

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 600 points

Problem Statement

For a sequence $A = (A_1, \ldots, A_N)$ of length N, define $f(A)$ as follows.

- Prepare a graph with N vertices labeled 1 to N and zero edges. For every integer pair (i, j) satisfying $1 \le i < j \le N$, if $A_i \le A_j$, draw a bidirectional edge connecting vertices i and j. Define $f(A)$ as the number of connected components in the resulting graph.

You are given a sequence $B = (B_1, \ldots, B_N)$ of length N. Each element of B is -1 or an integer between 1 and M, inclusive.

By replacing every occurrence of -1 in B with an integer between 1 and M, one can obtain M^q sequences B', where q is the number of -1 in B.

Find the sum, modulo 998244353, of $f(B')$ over all possible B'.

Constraints

- All input numbers are integers.
- $2 \le N \le 2000$
- $1 \le M \le 2000$
- Each B_i is -1 or an integer between 1 and M, inclusive.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \quad M \\
B_1 \quad \ldots \quad B_N
\end{array}
$$

Output

Print the answer.

Sample Input 1

```
3 3
2 -1 1
```

Sample Output 1

```
6
```

There are three possible sequences B': $(2,1,1)$, $(2,2,1)$, and $(2,3,1)$.

When $B' = (2,1,1)$, an edge is drawn only between vertices 2 and 3, so the number of connected components is 2. Thus, $f(B') = 2$.

Similarly, $f(B') = 2$ for $B' = (2,2,1)$ and $f(B') = 2$ for $B' = (2,3,1)$, so the answer is $2+2+2 = 6$.

Sample Input 2

```
10 8
-1 7 -1 -1 -1 2 -1 1 -1 2
```

Sample Output 2

```
329785
```

Sample Input 3

```
11 12
-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
```

Sample Output 3

```
529513150
```

Remember to find the sum modulo 998244353.

C - 1 Loop Bubble Sort

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 800 points

Problem Statement

For a permutation $P = (P_1, \dots, P_N)$ of $(1, \dots, N)$, let $P' = (P'_1, \dots, P'_N)$ be the permutation obtained by performing the following operation once.

- For $i = 1, 2, \dots, N-1$ in this order, if $P_i > P_{i+1}$, swap P_i and P_{i+1}.

You are given a sequence $Q = (Q_1, \dots, Q_N)$ of length N. Each Q_i is -1 or an integer between 1 and N, inclusive.

Find the number, modulo 998244353, of permutations P of $(1, \dots, N)$ such that, for every i, if $Q_i \neq -1$ then $Q_i = P'_i$.

Constraints

- All input numbers are integers.
- $2 \le N \le 5000$
- Each Q_i is -1 or an integer between 1 and N.
- Each of $1, 2, \dots, N$ appears at most once in Q.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
Q_1 \ \dots \ Q_N
\end{array}
$$

Output

Print the answer.

Sample Input 1

```
4
-1 -1 2 4
```

Sample Output 1

```
6
```

For example, $P = (3, 1, 4, 2)$ satisfies the conditions. This can be confirmed by the following behavior of the operation.

- For $i = 1$, since $P_1 > P_2$, swap P_1 and P_2, resulting in $P = (1, 3, 4, 2)$.
- For $i = 2$, since $P_2 < P_3$, do nothing.
- For $i = 3$, since $P_3 > P_4$, swap P_3 and P_4, resulting in $P = (1, 3, 2, 4)$.
- Thus, $P' = (1, 3, 2, 4)$, satisfying $P'_3 = 2$ and $P'_4 = 4$.

There are six permutations P that satisfy the conditions:

- $(1, 3, 4, 2)$
- $(1, 4, 3, 2)$
- $(3, 1, 4, 2)$
- $(3, 4, 1, 2)$
- $(4, 1, 3, 2)$
- $(4, 3, 1, 2)$

Sample Input 2

```
6
-1 -1 -1 -1 2 -1
```

Sample Output 2

```
120
```

Sample Input 3

```
15
-1 -1 -1 -1 -1 4 -1 -1 -1 -1 7 -1 -1 -1 -1
```

Sample Output 3

```
237554682
```

Remember to find the count modulo 998244353.

D - Many Easy Optimizations

Time Limit: 5 sec / Memory Limit: 1024 MiB

Score : 900 points

Problem Statement

Define the **cost** of a sequence X as (the maximum value of X minus the minimum value of X).

You are given sequences $A = (A_1, \ldots, A_N)$ and $B = (B_1, \ldots, B_N)$ of length N. Solve the following problem for $k = 1, 2, \ldots, N$.

- Find the minimum possible cost of the sequence $C = (C_1, \ldots, C_k)$ whose i-th element C_i is A_i or B_i.

Constraints

- All input numbers are integers.
- $1 \leq N \leq 5 \times 10^5$
- $1 \leq A_i, B_i \leq 10^9$

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
A_1 \quad \ldots \quad A_N \\
B_1 \quad \ldots \quad B_N
\end{array}
$$

Output

Print N lines.

The i-th line $(1 \leq i \leq N)$ should contain the minimum possible cost of sequence C for $k = i$.

Sample Input 1

```
3
8 11 10
7 6 1
```

Sample Output 1

```
0
1
3
```

For $k = 1$, if we choose $C = (8)$, the cost of C is 0, which is the minimum.

For $k = 2$, if we choose $C = (7, 6)$, the cost of C is 1, which is the minimum.

For $k = 3$, if we choose $C = (8, 11, 10)$, the cost of C is 3, which is the minimum.

Sample Input 2

```
10
43 35 36 58 25 7 61 4 96 3
55 29 88 15 99 49 67 57 92 49
```

Sample Output 2

```
0
8
8
23
28
33
36
36
64
64
```

E - Replace Triplets

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 1000 points

Problem Statement

You are given a sequence $A = (A_1, \ldots, A_N)$ of length N. Here, N is an integer not less than 3.

You can perform the following operation any number of times (zero or more).

- Choose an integer i satisfying $1 \leq i \leq N$ and $A_i = A_{i+1} = A_{i+2}$. Replace two of A_i, A_{i+1}, and A_{i+2} with integers between 1 and N, inclusive. Here, assume $A_{N+1} = A_1$ and $A_{N+2} = A_2$.

Find the number, modulo 998244353, of possible resulting sequences A that are permutations of $(1, \ldots, N)$.

Constraints

- All input numbers are integers.
- $3 \leq N \leq 5 \times 10^5$
- $1 \leq A_i \leq N$

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l} N \\ A_1 \ \ldots \ A_N \end{array}
$$

Output

Print the answer.

Sample Input 1

```
6
1 2 3 3 1 1
```

Sample Output 1

```
360
```

For example, we can obtain the permutation $A = (1, 2, 4, 3, 5, 6)$ through the following steps.

- Perform the operation with $i = 5$. Replace A_5 with 3 and A_6 with 6. Now, $A = (1, 2, 3, 3, 3, 6)$.
- Perform the operation with $i = 3$. Replace A_3 with 4 and A_5 with 5. Now, $A = (1, 2, 4, 3, 5, 6)$.

There are 360 possible resulting sequences A that are permutations of $(1, \ldots, 6)$.

Sample Input 2

```
5
3 1 3 4 1
```

Sample Output 2

```
0
```

There are no possible resulting sequences A that are permutations of $(1, \ldots, 5)$.

Sample Input 3

```
10
1 1 1 8 8 8 7 7 7 10
```

Sample Output 3

```
604800
```