A - 123233

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 100 points

Problem Statement

You are given a 6-digit positive integer N.

Determine whether N satisfies all of the following conditions.

- Among the digits of N, the digit 1 appears exactly once.
- Among the digits of N, the digit 2 appears exactly twice.
- Among the digits of N, the digit 3 appears exactly three times.

Constraints

- N is an integer satisfying $100000 \leq N \leq 999999$.

Input

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

N

Output

Print `Yes` if N satisfies all the conditions described in the problem statement, and `No` otherwise, in one line.

Sample Input 1

```
123233
```

Sample Output 1

```
Yes
```

123233 satisfies the conditions in the problem statement, so print `Yes`.

Sample Input 2

```
123234
```

Sample Output 2

```
No
```

123234 does not satisfy the conditions in the problem statement, so print No.

Sample Input 3

```
323132
```

Sample Output 3

```
Yes
```

Sample Input 4

```
500000
```

Sample Output 4

```
No
```

B - Hurdle Parsing

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 200 points

Problem Statement

Iroha has a sequence of positive integers $A = (A_1, A_2, \ldots, A_N)$ of length N ($N \geq 1$).
She generated a string S using A as follows:

- Start with $S =$ |.
- For $i = 1, 2, \ldots, N$, perform the following operations in order:
  - Append A_i copies of - to the end of S.
  - Then, append one | to the end of S.

Given the generated string S, reconstruct the sequence A.

Constraints

- S is a string of length between 3 and 100, inclusive, generated by the method in the problem statement.
- A is a sequence of positive integers of length at least 1.

Input

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

```
S
```

Output

Print the answer in the following format, with elements separated by spaces in a single line:

```
A_1 A_2 ... A_N
```

Sample Input 1

```
|---|-|----|-|-----|
```

Sample Output 1

```
3 1 4 1 5
```

$S =$ |---|-|----|-|-----| is generated by $A = (3, 1, 4, 1, 5)$.

Sample Input 2

```
|----------|
```

Sample Output 2

```
10
```

Sample Input 3

```
|-|-|-|------|
```

Sample Output 3

```
1 1 1 6
```

C - Move Segment

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 300 points

Problem Statement

You are given a string S of length N consisting of `0` and `1`.
Move the K-th `1`-block from the beginning in S to immediately after the $(K-1)$-th `1`-block, and print the resulting string.

It is guaranteed that S contains at least K `1`-blocks.

Here is a more precise description.

- Let $S_{l\ldots r}$ denote the substring of S from the l-th character through the r-th character.
- We define a substring $S_{l\ldots r}$ of S to be a `1`-block if it satisfies all of the following conditions:
  - $S_l = S_{l+1} = \cdots = S_r =$ `1`
  - $l = 1$ or $S_{l-1} =$ `0`
  - $r = N$ or $S_{r+1} =$ `0`
- Suppose that all `1`-blocks in S are $S_{l_1\ldots r_1}, \ldots, S_{l_m\ldots r_m}$, where $l_1 < l_2 < \cdots < l_m$.

  Then, we define the length N string T, obtained by moving the K-th `1`-block to immediately after the $(K-1)$-th `1`-block, as follows:

  - $T_i = S_i$ for $1 \leq i \leq r_{K-1}$
  - $T_i =$ `1` for $r_{K-1}+1 \leq i \leq r_{K-1} + (r_K - l_K) + 1$
  - $T_i =$ `0` for $r_{K-1} + (r_K - l_K) + 2 \leq i \leq r_K$
  - $T_i = S_i$ for $r_K + 1 \leq i \leq N$

Constraints

- $1 \leq N \leq 5 \times 10^5$
- S is a string of length N consisting of `0` and `1`.
- $2 \leq K$
- S contains at least K `1`-blocks.

Input

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

N K
S

Output

Print the answer.

Sample Input 1

```
15 3
010011100011001
```

Sample Output 1

```
010011111000001
```

S has four 1-blocks: from the 2nd to the 2nd character, from the 5th to the 7th character, from the 11th to the 12th character, and from the 15th to the 15th character.

Sample Input 2

```
10 2
1011111111
```

Sample Output 2

```
1111111110
```

D - Strange Mirroring

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 350 points

Problem Statement

You are given a string S consisting of uppercase and lowercase English letters.

We perform the following operation on S 10^{100} times:

- First, create a string T by changing uppercase letters in S to lowercase, and lowercase letters to uppercase.
- Then, concatenate S and T in this order to form a new S.

Answer Q queries. The i-th query is as follows:

- Find the K_i-th character from the beginning of S after all operations are completed.

Constraints

- S is a string consisting of uppercase and lowercase English letters, with length between 1 and 2×10^5, inclusive.
- Q and K_i are integers.
- $1 \leq Q \leq 2 \times 10^5$
- $1 \leq K_i \leq 10^{18}$

Input

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

S
Q
$K_1 \quad K_2 \quad \dots \quad K_Q$

Output

Let C_i be the answer to the i-th query. Print them in a single line, separated by spaces, in the following format:

$C_1 \quad C_2 \quad \dots \quad C_Q$

Sample Input 1

```
aB
16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
```

Sample Output 1

```
a B A b A b a B A b a B a B A b
```

Before the operations, $S =$ aB.

- After performing the operation once on aB, it becomes aBAb.
- After performing the operation twice on aB, it becomes aBAbAbaB.
- ...

After performing the operation 10^{100} times, $S =$ aBAbAbaBAbaBaBAb...

Sample Input 2

```
qWeRtYuIoP
8
1 1 2 3 5 8 13 21
```

Sample Output 2

```
q q W e t I E Q
```

Sample Input 3

```
AnUoHrjhgfLMcDIpzxXmEWPwBZvbKqQuiJTtFSlkNGVReOYCdsay
5
100000000000000000 123456789 1 987654321 999999999999999999
```

Sample Output 3

```
K a A Z L
```

E - 1D Bucket Tool

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 450 points

Problem Statement

There are N cells in a row, numbered 1 to N.
For each $1 \leq i < N$, cells i and $i+1$ are adjacent.

Initially, cell i is painted with color i.

You are given Q queries. Process them in order. Each query is of one of the following two types.

- `1 x c`: Repaint the following to color c: all reachable cells reachable from cell x by repeatedly moving to an adjacent cell painted in the same color as the current cell.
- `2 c`: Print the number of cells painted with color c.

Constraints

- $1 \leq N \leq 5 \times 10^5$
- $1 \leq Q \leq 2 \times 10^5$
- In queries of the first type, $1 \leq x \leq N$.
- In queries of the first and second types, $1 \leq c \leq N$.
- There is at least one query of the second type.
- All input values are integers.

Input

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

$$
\begin{aligned}
&N \quad Q \\
&\mathrm{query}_1 \\
&\vdots \\
&\mathrm{query}_Q
\end{aligned}
$$

Each query is given in one of the following two formats:

$$1 \quad x \quad c$$

$$2 \quad c$$

Output

Let q be the number of queries of the second type. Print q lines.

The i-th line should contain the answer to the i-th such query.

Sample Input 1

```
5 6
1 5 4
1 4 2
2 2
1 3 2
1 2 3
2 3
```

Sample Output 1

```
3
4
```

The queries recolor the cells as shown in the figure.

F - Exchange Game

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 500 points

Problem Statement

Takahashi and Aoki will play a game using cards with numbers written on them.

Initially, Takahashi has N cards with numbers $A_1, \ldots, A_N$ in his hand, Aoki has M cards with numbers $B_1, \ldots, B_M$ in his hand, and there are L cards with numbers $C_1, \ldots, C_L$ on the table.
Throughout the game, both Takahashi and Aoki know all the numbers on all the cards, including the opponent's hand.

Starting with Takahashi, they take turns performing the following action:

- Choose one card from his hand and put it on the table. Then, if there is a card on the table with a number less than the number on the card he just played, he may take one such card from the table into his hand.

The player who cannot make a move first loses, and the other player wins. Determine who wins if both players play optimally.

It can be proved that the game always ends in a finite number of moves.

Constraints

- $1 \leq N, M, L$
- $N + M + L \leq 12$
- $1 \leq A_i, B_i, C_i \leq 10^9$
- All input values are integers.

Input

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

$$
\begin{array}{llll}
N & M & L & \\
A_1 & \ldots & A_N & \\
B_1 & \ldots & B_M & \\
C_1 & \ldots & C_L &
\end{array}
$$

Output

Print `Takahashi` if Takahashi wins, and `Aoki` if Aoki wins.

Sample Input 1

```
1 1 2
2
4
1 3
```

Sample Output 1

```
Aoki
```

The game may proceed as follows (not necessarily optimal moves):

- Takahashi plays 2 from his hand to the table, and takes 1 from the table into his hand. Now, Takahashi's hand is (1), Aoki's hand is (4), and the table cards are $(2, 3)$.
- Aoki plays 4 from his hand to the table, and takes 2 into his hand. Now, Takahashi's hand is (1), Aoki's hand is (2), and the table cards are $(3, 4)$.
- Takahashi plays 1 from his hand to the table. Now, Takahashi's hand is $()$, Aoki's hand is (2), and the table cards are $(1, 3, 4)$.
- Aoki plays 2 from his hand to the table. Now, Takahashi's hand is $()$, Aoki's hand is $()$, and the table cards are $(1, 2, 3, 4)$.
- Takahashi cannot make a move and loses; Aoki wins.

Sample Input 2

```
4 4 4
98 98765 987654 987654321
987 9876 9876543 98765432
123 12345 1234567 123456789
```

Sample Output 2

```
Takahashi
```

Sample Input 3

```
1 1 8
10
10
1 2 3 4 5 6 7 8
```

Sample Output 3

```
Aoki
```

G - Another Shuffle Window

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 575 points

Problem Statement

You are given a permutation P of $(1, 2, \ldots, N)$ and an integer K.

Find the expected value, modulo 998244353, of the inversion number of P after performing the following operation:

- First, choose an integer i uniformly at random between 1 and $N - K + 1$, inclusive.
- Then, shuffle $P_i, P_{i+1}, \ldots, P_{i+K-1}$ uniformly at random.

▶ What is the inversion number?

▶ What does "expected value modulo 998244353" mean?

Constraints

- All input values are integers.
- $1 \leq K \leq N \leq 2 \times 10^5$
- P is a permutation of $(1, 2, \ldots, N)$.

Input

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

N K
P_1 P_2 $\ldots$ P_N

Output

Print the answer in one line.

Sample Input 1

```
4 2
1 4 2 3
```

Sample Output 1

```
166374061
```

The operation changes the permutation P into the following:

- $(1, 4, 2, 3)$ ... probability $1/2$
- $(4, 1, 2, 3)$ ... probability $1/6$
- $(1, 2, 4, 3)$ ... probability $1/6$
- $(1, 4, 3, 2)$ ... probability $1/6$

The expected value of the inversion number is $2 \times \dfrac{1}{2} + 3 \times \dfrac{1}{6} + 1 \times \dfrac{1}{6} + 3 \times \dfrac{1}{6} = \dfrac{13}{6}$.

$\dfrac{13}{6}$ modulo 998244353 is 166374061, so print this number.

Sample Input 2

```
1 1
1
```

Sample Output 2

```
0
```

Sample Input 3

```
10 6
7 4 10 5 6 1 8 2 3 9
```

Sample Output 3

```
499122200
```