A - 11/22 String

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 150 points

Problem Statement

> The definition of an 11/22 string in this problem is the same as in Problems C and E.

A string T is called an **11/22 string** when it satisfies all of the following conditions:

- $|T|$ is odd. Here, $|T|$ denotes the length of T.
- The 1-st through $\left(\frac{|T|+1}{2}-1\right)$-th characters are all `1`.
- The $\left(\frac{|T|+1}{2}\right)$-th character is `/`.
- The $\left(\frac{|T|+1}{2}+1\right)$-th through $|T|$-th characters are all `2`.

For example, `11/22`, `111/222`, and `/` are 11/22 strings, but `1122`, `1/22`, `11/2222`, `22/11`, and `//2/2/211` are not.

Given a string S of length N consisting of `1`, `2`, and `/`, determine whether S is an 11/22 string.

Constraints

- $1 \leq N \leq 100$
- S is a string of length N consisting of `1`, `2`, and `/`.

Input

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

```
N
S
```

Output

If S is an 11/22 string, print `Yes`; otherwise, print `No`.

Sample Input 1

```
5
11/22
```

Sample Output 1

```
Yes
```

`11/22` satisfies the conditions for an 11/22 string in the problem statement.

Sample Input 2

```
1
/
```

Sample Output 2

```
Yes
```

`/` satisfies the conditions for an 11/22 string.

Sample Input 3

```
4
1/22
```

Sample Output 3

```
No
```

`1/22` does not satisfy the conditions for an 11/22 string.

Sample Input 4

```
5
22/11
```

Sample Output 4

```
No
```

B - 1122 String

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 150 points

Problem Statement

A string T is called a **1122 string** if and only if it satisfies all of the following three conditions:

- $|T|$ is even. Here, $|T|$ denotes the length of T.
- For each integer i satisfying $1 \leq i \leq \frac{|T|}{2}$, the $(2i-1)$-th and $2i$-th characters of T are equal.
- Each character appears in T exactly zero or two times. That is, every character contained in T appears exactly twice in T.

Given a string S consisting of lowercase English letters, print `Yes` if S is a 1122 string, and `No` otherwise.

Constraints

- S is a string of length between 1 and 100, inclusive, consisting of lowercase English letters.

Input

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

S

Output

If S is a 1122 string, print `Yes`; otherwise, print `No`.

Sample Input 1

```
aabbcc
```

Sample Output 1

```
Yes
```

$S =$ aabbcc satisfies all the conditions for a 1122 string, so print Yes.

Sample Input 2

```
aab
```

Sample Output 2

```
No
```

$S =$ aab has an odd length and does not satisfy the first condition, so print No.

Sample Input 3

```
zzzzzz
```

Sample Output 3

```
No
```

$S =$ zzzzzz contains six zs and does not satisfy the third condition, so print No.

C - 11/22 Substring

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 300 points

Problem Statement

> The definition of an 11/22 string in this problem is the same as in Problems A and E.

A string T is called an **11/22 string** when it satisfies all of the following conditions:

- $|T|$ is odd. Here, $|T|$ denotes the length of T.
- The 1-st through $(\frac{|T|+1}{2}-1)$-th characters are all `1`.
- The $(\frac{|T|+1}{2})$-th character is `/`.
- The $(\frac{|T|+1}{2}+1)$-th through $|T|$-th characters are all `2`.

For example, `11/22`, `111/222`, and `/` are 11/22 strings, but `1122`, `1/22`, `11/2222`, `22/11`, and `//2/2/211` are not.

You are given a string S of length N consisting of `1`, `2`, and `/`, where S contains at least one `/`.

Find the maximum length of a (contiguous) substring of S that is an 11/22 string.

Constraints

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

Input

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

N
S

Output

Print the maximum length of a (contiguous) substring of S that is an 11/22 string.

Sample Input 1

```
8
211/2212
```

Sample Output 1

```
5
```

The substring from the 2-nd to 6-th character of S is `11/22`, which is an 11/22 string. Among all substrings of S that are 11/22 strings, this is the longest. Therefore, the answer is 5.

Sample Input 2

```
5
22/11
```

Sample Output 2

```
1
```

Sample Input 3

```
22
/1211/2///2111/2222/11
```

Sample Output 3

```
7
```

D - 1122 Substring

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 425 points

Problem Statement

A sequence $X = (X_1, X_2, \ldots)$ of positive integers (possibly empty) is called a **1122 sequence** if and only if it satisfies all of the following three conditions: (The definition of a 1122 sequence is the same as in Problem F.)

- $|X|$ is even. Here, $|X|$ denotes the length of X.
- For each integer i satisfying $1 \leq i \leq \frac{|X|}{2}$, X_{2i-1} and X_{2i} are equal.
- Each positive integer appears in X either not at all or exactly twice. That is, every positive integer contained in X appears exactly twice in X.

Given a sequence $A = (A_1, A_2, \ldots, A_N)$ of length N consisting of positive integers, print the maximum length of a **(contiguous) subarray** of A that is a 1122 sequence.

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $1 \leq A_i \leq N$
- All input values are integers.

Input

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

N
$A_1 \quad A_2 \quad \ldots \quad A_N$

Output

Print the maximum length of a (contiguous) subarray of A that is a 1122 sequence.

Sample Input 1

```
8
2 3 1 1 2 2 1 1
```

Sample Output 1

```
4
```

For example, taking the subarray from the 3-rd to 6-th elements of A, we get $(1, 1, 2, 2)$, which is a 1122 sequence of length 4.
There is no longer (contiguous) subarray that satisfies the conditions for a 1122 sequence, so the answer is 4.

Sample Input 2

```
3
1 2 2
```

Sample Output 2

```
2
```

Sample Input 3

```
1
1
```

Sample Output 3

```
0
```

Note that a sequence of length 0 also satisfies the conditions for a 1122 sequence.

E - 11/22 Subsequence

Time Limit: 3 sec / Memory Limit: 1024 MiB

Score : 500 points

Problem Statement

> The definition of an 11/22 string in this problem is the same as in Problems A and C.

A string T is called an **11/22 string** when it satisfies all of the following conditions:

- $|T|$ is odd. Here, $|T|$ denotes the length of T.
- The 1-st through $(\frac{|T|+1}{2}-1)$-th characters are all `1`.
- The $(\frac{|T|+1}{2})$-th character is `/`.
- The $(\frac{|T|+1}{2}+1)$-th through $|T|$-th characters are all `2`.

For example, `11/22`, `111/222`, and `/` are 11/22 strings, but `1122`, `1/22`, `11/2222`, `22/11`, and `//2/2/211` are not.

Given a string S of length N consisting of `1`, `2`, and `/`, process Q queries.

Each query provides two integers L and R. Let T be the **(contiguous)** substring of S from the L-th through R-th character. Find the maximum length of a subsequence **(not necessarily contiguous)** of T that is an 11/22 string. If no such subsequence exists, print `0`.

Constraints

- $1 \leq N \leq 10^5$
- $1 \leq Q \leq 10^5$
- S is a string of length N consisting of `1`, `2`, and `/`.
- $1 \leq L \leq R \leq N$
- $N, Q, L,$ and R are integers.

Input

The input is given from Standard Input in the following format. Here, query_i denotes the i-th query.

$$
\begin{aligned}
&N \quad Q\\
&S\\
&\mathrm{query}_1\\
&\mathrm{query}_2\\
&\vdots\\
&\mathrm{query}_Q
\end{aligned}
$$

Each query is given in the following format:

$$
L \quad R
$$

Output

Print Q lines. The i-th line should contain the answer to the i-th query.

Sample Input 1

```
12 5
111/212/1122
1 7
9 12
3 6
4 10
1 12
```

Sample Output 1

```
5
0
3
1
7
```

For the first query, the substring from the 1-st to 7-th character of S is `111/212`. This string contains `11/22` as a subsequence, which is the longest subsequence that is an 11/22 string. Therefore, the answer is 5.
For the second query, the substring from the 9-th to 12-th character of S is `1122`. This string does not contain any subsequence that is an 11/22 string, so the answer is 0.

F - 1122 Subsequence

Time Limit: 3 sec / Memory Limit: 1024 MiB

Score : 525 points

Problem Statement

A sequence $X = (X_1, X_2, \ldots)$ of positive integers (possibly empty) is called a **1122 sequence** if and only if it satisfies all of the following three conditions: (The definition of a 1122 sequence is the same as in Problem D.)

- $|X|$ is even. Here, $|X|$ denotes the length of X.
- For each integer i satisfying $1 \leq i \leq \frac{|X|}{2}$, X_{2i-1} and X_{2i} are equal.
- Each positive integer appears in X either not at all or exactly twice. That is, every positive integer contained in X appears exactly twice in X.

Given a sequence $A = (A_1, A_2, \ldots, A_N)$ of length N consisting of positive integers, print the maximum length of a **subsequence (not necessarily contiguous)** of A that is a 1122 sequence.

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $1 \leq A_i \leq 20$
- All input values are integers.

Input

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

N
$A_1 \quad A_2 \quad \ldots \quad A_N$

Output

Print the maximum length of a (not necessarily contiguous) subsequence of A that is a 1122 sequence.

Sample Input 1

```
7
1 3 3 1 2 2 1
```

Sample Output 1

```
4
```

For example, choosing the 1-st, 4-th, 5-th, and 6-th elements of A, we get $(1, 1, 2, 2)$, which is a 1122 sequence of length 4.
There is no longer subsequence that satisfies the conditions for a 1122 sequence, so the answer is 4.

Sample Input 2

```
1
20
```

Sample Output 2

```
0
```

G - Fibonacci Product

Time Limit: 4 sec / Memory Limit: 1024 MiB

Score : 675 points

Problem Statement

Define a sequence $a_1, a_2, a_3, \ldots$ as follows:

$$a_n = \begin{cases} x & (n = 1) \\ y & (n = 2) \\ a_{n-1} + a_{n-2} & (n \geq 3) \end{cases}$$

Find $(\prod_{i=1}^{N} a_i) \bmod 998244353$.

You are given T test cases to solve.

Constraints

- $1 \leq T \leq 5$
- $1 \leq N \leq 10^{18}$
- $0 \leq x \leq 998244352$
- $0 \leq y \leq 998244352$
- All input values are integers.

Input

The input is given from Standard Input in the following format. Here, case_i denotes the i-th test case.

T
case_1
case_2
$\vdots$
case_T

Each test case is given in the following format:

N x y

Output

Print T lines. The i-th line should contain the answer to the i-th test case.

Sample Input 1

```
3
5 1 1
2024 11 22
100000000000000000 12345 6789
```

Sample Output 1

```
30
577322229
726998219
```

For the first test case, the elements of the sequence are $1, 1, 2, 3, 5, 8, \ldots$. Thus, the answer is $(1 \times 1 \times 2 \times 3 \times 5) \bmod 998244353 = 30$.