A - Conflict

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 100 points

Problem Statement

There are N items. You are given strings T and A of length N that represent which items Takahashi and Aoki want, respectively. Let T_i and A_i be the i-th $(1 \leq i \leq N)$ characters of T and A, respectively.

Takahashi wants the i-th item when T_i is `o`, and does not want the i-th item when T_i is `x`. Similarly, Aoki wants the i-th item when A_i is `o`, and does not want the i-th item when A_i is `x`.

Determine whether there exists an item that both of them want.

Constraints

- $1 \leq N \leq 100$
- N is an integer.
- T and A are strings of length N consisting of `o` and `x`.

Input

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

$$N$$
$$T$$
$$A$$

Output

If there exists an item that both of them want, output `Yes`; otherwise, output `No`.

Sample Input 1

```
4
oxoo
xoox
```

Sample Output 1

```
Yes
```

The third item is wanted by both of them, so output `Yes`.

Sample Input 2

```
5
xxxxx
ooooo
```

Sample Output 2

```
No
```

There is no item that both of them want, so output `No`.

Sample Input 3

```
10
xoooxoxxxo
ooxooooxoo
```

Sample Output 3

```
Yes
```

B - Citation

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 200 points

Problem Statement

You are given a sequence of non-negative integers $A = (A_1, A_2, \ldots, A_N)$ of length N. Find the maximum non-negative integer x that satisfies the following:

- In A, elements greater than or equal to x appear at least x times (including duplicates).

Constraints

- $1 \leq N \leq 100$
- $0 \leq A_i \leq 10^9$
- All input values are integers.

Input

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

$$
\begin{array}{l}
N \\
A_1 \quad A_2 \quad \ldots \quad A_N
\end{array}
$$

Output

Output the answer.

Sample Input 1

```
3
1 2 1
```

Sample Output 1

```
1
```

In $A = (1, 2, 1)$:

- Elements greater than or equal to 0 appear 3 times.
- Elements greater than or equal to 1 appear 3 times.
- Elements greater than or equal to 2 appear 1 time.
- Elements greater than or equal to 3 appear 0 times.

The maximum non-negative integer that satisfies the condition is 1.

Sample Input 2

```
7
1 6 2 10 2 3 2
```

Sample Output 2

```
3
```

C - Equilateral Triangle

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 300 points

Problem Statement

There is a circle with circumference L, and points $1, 2, \ldots, N$ are placed on this circle. For $i = 1, 2, \ldots, N-1$, point $i+1$ is located at a position that is d_i clockwise from point i on the circle.

Find the number of integer triples (a, b, c) $(1 \leq a < b < c \leq N)$ that satisfy both of the following conditions:

- The three points a, b, and c are all at different positions.
- The triangle with vertices at the three points a, b, and c is an equilateral triangle.

Constraints

- $3 \leq L, N \leq 3 \times 10^5$
- $0 \leq d_i < L$
- All input values are integers.

Input

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

$$N \quad L$$
$$d_1 \quad d_2 \quad \ldots \quad d_{N-1}$$

Output

Output the answer.

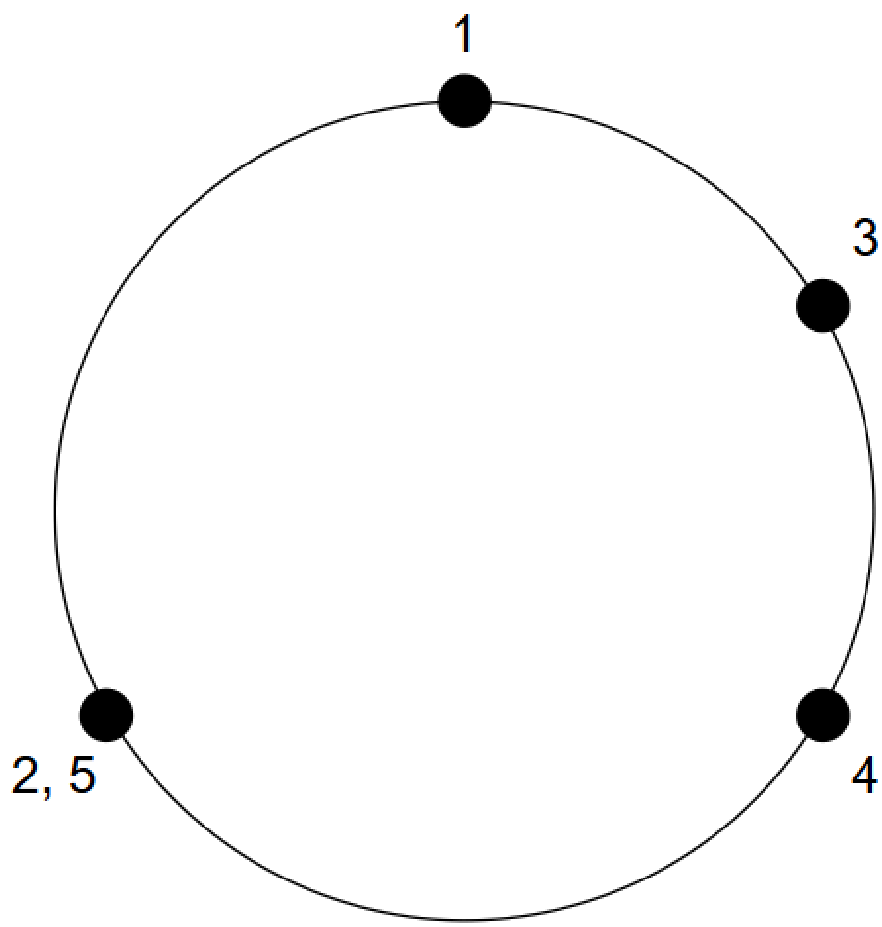
Sample Input 1

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

Sample Output 1

```
2
```

The arrangement of the five points is as follows. Two pairs satisfy the conditions: $(a, b, c) = (1, 2, 4), (1, 4, 5)$.



Sample Input 2

```
4 4
1 1 1
```

Sample Output 2

```
0
```

Sample Input 3

```
10 12
4 4 5 7 1 7 0 8 5
```

Sample Output 3

```
13
```

D - String Rotation

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 400 points

Problem Statement

You are given a string $S = S_1 S_2 \ldots S_N$ of length N consisting of lowercase English letters. You will perform the following operation on S exactly once:

- Choose a contiguous substring of S with length at least 1 and cyclically shift it to the left by 1. That is, choose integers $1 \le \ell \le r \le N$, insert S_ℓ to the right of the r-th character of S, and then delete the ℓ-th character of S.

Find the lexicographically smallest string among all possible strings that S can become after the operation.

You are given T test cases, so solve each of them.

Constraints

- $1 \le T \le 10^5$
- $1 \le N \le 10^5$
- S is a string of length N consisting of lowercase English letters.
- T and N are integers.
- The sum of N over all test cases in a single input file is at most 10^5.

Input

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

$$
\begin{array}{l}
T \\
\mathrm{case}_1 \\
\mathrm{case}_2 \\
\vdots \\
\mathrm{case}_T
\end{array}
$$

Each test case case_i $(1 \le i \le T)$ is given in the following format:

$$
\begin{array}{l}
N \\
S
\end{array}
$$

Output

Output T lines. The i-th $(1 \leq i \leq T)$ line should contain the answer for case_i.

Sample Input 1

```
3
7
atcoder
1
x
5
snuke
```

Sample Output 1

```
acodert
x
nsuke
```

- In the first test case, cyclically shifting from the 2nd to the 7th character gives `acodert`, which is lexicographically smallest.
- In the second test case, no matter how you operate, you get `x`.
- In the third test case, cyclically shifting from the 1st to the 2nd character gives `nsuke`, which is lexicographically smallest.

E - Pair Annihilation

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 425 points

Problem Statement

You are given a tree with N vertices. The vertices are numbered $1, 2, \ldots, N$, and the edges are numbered $1, 2, \ldots, N-1$. Edge j bidirectionally connects vertices u_j and v_j and has weight w_j. Also, vertex i is given an integer x_i. If $x_i > 0$, then x_i positrons are placed at vertex i. If $x_i < 0$, then $-x_i$ electrons are placed at vertex i. If $x_i = 0$, then nothing is placed at vertex i. Here, it is guaranteed that $\sum_{i=1}^{N} x_i = 0$.

Moving one positron or electron along edge j costs energy w_j. Also, when a positron and an electron are at the same vertex, they annihilate each other in equal numbers.

Find the minimum energy required to annihilate all positrons and electrons.

Constraints

- $2 \leq N \leq 10^5$
- $|x_i| \leq 10^4$
- $\sum_{i=1}^{N} x_i = 0$
- $1 \leq u_j < v_j \leq N$
- $0 \leq w_j \leq 10^4$
- The given graph is a tree.
- All input values are integers.

Input

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

$$
\begin{array}{l}
N \\
x_1 \quad x_2 \quad \ldots \quad x_N \\
u_1 \quad v_1 \quad w_1 \\
u_2 \quad v_2 \quad w_2 \\
\vdots \\
u_{N-1} \quad v_{N-1} \quad w_{N-1}
\end{array}
$$

Output

Output the answer.

Sample Input 1

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

Sample Output 1

```
9
```

Initially, $x = (x_1, x_2, x_3, x_4) = (-3, +2, +2, -1)$. By operating as follows, all positrons and electrons can be annihilated with energy 9:

- Move one electron at vertex 1 to vertex 2. This costs energy 2, and $x = (-2, +1, +2, -1)$.
- Move one positron at vertex 2 to vertex 1. This costs energy 2, and $x = (-1, 0, +2, -1)$.
- Move one electron at vertex 4 to vertex 1. This costs energy 3, and $x = (-2, 0, +2, 0)$.
- Move one electron at vertex 1 to vertex 3. This costs energy 1, and $x = (-1, 0, +1, 0)$.
- Move one electron at vertex 1 to vertex 3. This costs energy 1, and $x = (0, 0, 0, 0)$.

It is impossible to annihilate all positrons and electrons with energy 8 or less, so the answer is 9.

Sample Input 2

```
2
0 0
1 2 1
```

Sample Output 2

```
0
```

The condition may already be satisfied from the beginning.

Sample Input 3

```
5
-2 -8 10 -2 2
3 5 1
1 3 5
2 5 0
3 4 6
```

Sample Output 3

```
28
```

F - Connecting Points

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 500 points

Problem Statement

There is a graph G with N vertices and 0 edges on a 2-dimensional plane. The vertices are numbered from 1 to N, and vertex i is located at coordinates (x_i, y_i).

For vertices u and v of G, the distance $d(u, v)$ between u and v is defined as the Manhattan distance $d(u, v) = |x_u - x_v| + |y_u - y_v|$.

Also, for two connected components A and B of G, let $V(A)$ and $V(B)$ be the vertex sets of A and B, respectively. The distance $d(A, B)$ between A and B is defined as $d(A, B) = \min\{d(u, v) \mid u \in V(A), v \in V(B)\}$.

Process Q queries as described below. Each query is one of the following three types:

- `1 a b` : Let n be the number of vertices in G. Add vertex $n + 1$ to G with coordinates $(x_{n+1}, y_{n+1}) = (a, b)$.
- `2` : Let n be the number of vertices in G and m be the number of connected components.
  - If $m = 1$, output `-1`.
  - If $m \geq 2$, merge all connected components with the minimum distance and output the value of that minimum distance. Formally, let the connected components of G be $A_1, A_2, \dots, A_m$ and let $k = \min\limits_{1 \leq i < j \leq m} d(A_i, A_j)$. For all pairs of vertices (u, v) $(1 \leq u < v \leq n)$ that are not in the same connected component and satisfy $d(u, v) = k$, add an edge between vertices u and v. Then, output k.
- `3 u v` : If vertices u and v are in the same connected component, output `Yes`; otherwise, output `No`.

Constraints

- $2 \leq N \leq 1500$
- $1 \leq Q \leq 1500$
- $0 \leq x_i, y_i \leq 10^9$
- For queries of type $1, 0 \leq a, b \leq 10^9$.
- For queries of type 3, let n be the number of vertices in G just before processing that query, then $1 \leq u < v \leq n$.
- All input values are integers.

Input

The input is given from Standard Input in the following format, where query_i is the i-th query to be processed.

$$
\begin{array}{l}
N \quad Q \\
x_1 \quad y_1 \\
x_2 \quad y_2 \\
\vdots \\
x_N \quad y_N \\
\mathrm{query}_1 \\
\mathrm{query}_2 \\
\vdots \\
\mathrm{query}_Q
\end{array}
$$

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

$$1 \quad a \quad b$$

$$2$$

$$3 \quad u \quad v$$

Output

Output the answers to the queries separated by newlines, following the instructions in the problem statement.

Sample Input 1

```
4 11
3 4
3 3
7 3
2 2
3 1 2
2
3 1 2
1 6 4
2
3 2 5
2
3 2 5
2
1 2 2
2
```

Sample Output 1

```
No
1
Yes
2
No
3
Yes
-1
0
```

Initially, vertices $1, 2, 3, 4$ are located at coordinates $(3, 4), (3, 3), (7, 3), (2, 2)$, respectively.

- For the 1st query, vertices 1 and 2 are not connected, so output `No`.
- For the 2nd query, there are 4 connected components, and the vertex set of each connected component is $\{1\}, \{2\}, \{3\}, \{4\}$. The minimum distance between different connected components is 1, and an edge is added between vertices 1 and 2. Output 1.
- For the 3rd query, vertices 1 and 2 are connected, so output `Yes`.
- For the 4th query, add vertex 5 at coordinates $(6, 4)$.
- For the 5th query, there are 4 connected components, and the vertex set of each connected component is $\{1, 2\}, \{3\}, \{4\}, \{5\}$. The minimum distance between different connected components is 2, and edges are added between vertices 2 and 4 and between vertices 3 and 5. Output 2.
- For the 6th query, vertices 2 and 5 are not connected, so output `No`.
- For the 7th query, there are 2 connected components, and the vertex set of each connected component is $\{1, 2, 4\}, \{3, 5\}$. The minimum distance between different connected components is 3, and an edge is added between vertices 1 and 5. Output 3.
- For the 8th query, vertices 2 and 5 are connected, so output `Yes`.
- For the 9th query, there is 1 connected component, so output -1.
- For the 10th query, add vertex 6 at coordinates $(2, 2)$.
- For the 11th query, there are 2 connected components, and the vertex set of each connected component is $\{1, 2, 3, 4, 5\}, \{6\}$. The minimum distance between different connected components is 0, and an edge is added between vertices 4 and 6. Output 0.

G - Accumulation of Wealth

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 625 points

Problem Statement

You are given an integer $N \geq 2$ and an integer P between 0 and 100, inclusive. Let $p = P/100$.

There is a sequence A. Initially, the length of A is 1, and its only element is 1.

The following operation is repeated $N-1$ times on sequence A:

- Let m be the smallest positive integer that does not appear in A. With probability p, perform operation 1; with probability $1-p$, perform operation 2:
  - Operation 1: Append m to the end of A.
  - Operation 2: Let $c_1, c_2, \ldots, c_{m-1}$ be the number of times $1, 2, \ldots, m-1$ appear in A, respectively. Choose an integer k between 1 and $m-1$, inclusive, with probability proportional to c_k. That is, choose k with probability $c_k / \sum_{j=1}^{m-1} c_j$. Then, append k to the end of A.

For each $k = 1, 2, \ldots, N$, find the expected number of occurrences of k in A after $N-1$ operations, modulo 998244353.

▶ Definition of expected value modulo 998244353

Constraints

- $2 \leq N \leq 10^5$
- $0 \leq P \leq 100$
- All input values are integers.

Input

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

$N \quad P$

Output

Output N lines. The k-th $(1 \leq k \leq N)$ line should contain the expected number of occurrences of k in A after the operations, modulo 998244353.

Sample Input 1

```
3 50
```

Sample Output 1

```
124780546
124780545
748683265
```

The operations proceed as follows:

- Initially, $A = (1)$.
- 1st operation: It becomes $A = (1, 2)$ with probability $1/2$, and $A = (1, 1)$ with probability $1/2$.
- 2nd operation:
  - If $A = (1, 2)$, it becomes $A = (1, 2, 3)$ with probability $1/2$, $A = (1, 2, 1)$ with probability $1/4$, and $A = (1, 2, 2)$ with probability $1/4$.
  - If $A = (1, 1)$, it becomes $A = (1, 1, 2)$ with probability $1/2$, and $A = (1, 1, 1)$ with probability $1/2$.

The expected numbers of occurrences of $1, 2, 3$ in the final A are $\frac{15}{8}$, $\frac{7}{8}$, $\frac{1}{4}$, respectively.

Sample Input 2

```
2 0
```

Sample Output 2

```
2
0
```

Sample Input 3

```
5 24
```

Sample Output 3

```
297734288
442981554
937492320
798158491
518366411
```