Polynomial Division

HackerRank

Consider a sequence, $c_0, c_1, \ldots c_{n-1}$, and a polynomial of degree 1 defined as $Q(x) = a \cdot x + b$. You must perform q queries on the sequence, where each query is one of the following two types:

- `1 i x`: Replace c_i with x.
- `2 l r`: Consider the polynomial $P(x) = c_l \cdot x^0 + c_{l+1} \cdot x^1 + \cdots + c_r \cdot x^{r-l}$ and determine whether $P(x)$ is divisible by $Q(x) = a \cdot x + b$ over the field Z_p, where $p = 10^9 + 7$. In other words, check if there exists a polynomial $R(x)$ with integer coefficients such that each coefficient of $P(x) - R(x) \cdot Q(x)$ is divisible by p. If a valid $R(x)$ exists, print `Yes` on a new line; otherwise, print `No`.

Given the values of n, a, b, and q queries, perform each query in order.

Input Format

The first line contains four space-separated integers describing the respective values of n (the length of the sequence), a (a coefficient in $Q(x)$), b (a coefficient in $Q(x)$), and q (the number of queries).
The second line contains n space-separated integers describing $c_0, c_1, \ldots c_{n-1}$.
Each of the q subsequent lines contains three space-separated integers describing a query of either type `1` or type `2`.

Constraints

- $1 \leq n, q \leq 10^5$
- For query type `1`: $0 \leq i \leq n-1$ and $0 \leq x < 10^9 + 7$.
- For query type `2`: $0 \leq l \leq r \leq n-1$.
- $0 \leq a, b, c_i < 10^9 + 7$
- $a \neq 0$

Output Format

For each query of type `2`, print `Yes` on a new line if $Q(x)$ is a divisor of $P(x)$; otherwise, print `No` instead.

Sample Input 0

```
3 2 2 3
1 2 3
2 0 2
1 2 1
2 0 2
```

Sample Output 0

```
No
Yes
```

Explanation 0

Given $Q(x) = 2 \cdot x + 2$ and the initial sequence $c = \{1, 2, 3\}$, we perform the following $q = 3$ queries:

1. $Q(x) = 2 \cdot x + 2$ is not a divisor of $P(x) = 1 + 2 \cdot x + 3 \cdot x^2$, so we print `No` on a new line.
2. Set c_2 to 1, so $c = \{1, 2, 1\}$.
3. After the second query, $P(x) = 1 + 2 \cdot x + 1 \cdot x^2$. Because $(2 \cdot x + 2) \cdot (500000004 \cdot x + 500000004) \bmod (10^9 + 7) = 1 + 2 \cdot x + 1 \cdot x^2 = P(x)$, we print `Yes` on a new line.