Finite Bracket Sequence

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 megabytes

The setting of this problem is the same as Problem G. The differences from Problem G are underlined.

You are given a string S of length N consisting only of `(` and `)`.

Answer Q queries. In the i-th query, you are given integers L_i and R_i. Solve the following problem:

> Let X be the substring of S from the L_i-th character to the R_i-th character. Consider choosing a positive integer k and then choosing a substring Y of the string obtained by concatenating k copies of X. Here, Y must be a regular bracket sequence. Y is allowed to be an empty string.
>
> Determine whether there exists a maximum possible length for Y.

Regular Bracket Sequence

A regular bracket sequence is a string that can be reduced to an empty string by repeatedly removing the contiguous substring `()` zero or more times.

Input

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

$$
\begin{array}{ll}
N & Q \\
S & \\
L_1 & R_1 \\
L_2 & R_2 \\
\vdots & \\
L_Q & R_Q
\end{array}
$$

- N, Q, L_i, R_i are integers.
- $1 \leq N \leq 2 \times 10^5$
- $1 \leq Q \leq 2 \times 10^5$
- S is a string of length N consisting only of `(` and `)`.
- $1 \leq L_i \leq R_i \leq N$

Output

Print Q lines. For the i-th line, print `Finite` if there exists a maximum possible length for Y in the i-th query, and `Infinite` otherwise.

Example

standard input	standard output
4 3 ()((2 3 1 4 3 4	Infinite Finite Finite

Note

- In the first query, $X =$ `)(`. For any positive integer k, if we concatenate k copies of X and remove the first and last characters, we obtain a regular bracket sequence of length $2k-2$. Therefore, there is no maximum possible length for Y, so you should print `Infinite`.
- In the second query, $X =$ `()((`. It can be proven that the maximum possible length of Y is 2. Therefore, print `Finite`.
- In the third query, $X =$ `((`. The maximum possible length of Y is 0, so print `Finite`. Note that Y can be an empty string.