

# Super Gray Pony

Input file:            **standard input**  
Output file:           **standard output**  
Time limit:            1 second  
Memory limit:         64 megabytes

Ponyville is on its annual math festival! The ponies who are able to overcome this problem would be honored as Super Gray Pony. Get yourself prepared for the problem and try your best!

In this problem, the  $i$ -order Gray Code is defined recursively as  $a^{(i)}$  - an array of binary numbers with  $2^i$  elements numbered from 0 to  $2^i - 1$ . Note that in this problem **leading zeros are added** to make each element a strictly  $i$ -bit binary number. The specific rules are as follows:

1. For  $i = 1$ ,  $a^{(1)} = [0, 1]$ ,  $a^{(1)}[0] = 0$ ,  $a^{(1)}[1] = 1$ .
2. For  $i > 1$ , the first half of  $a^{(i)}$  ( $a^{(i)}[0], \dots, a^{(i)}[2^{i-1} - 1]$ ) can be obtained by adding a digit 0 in front of the highest bit of each element in  $a^{(i-1)}$ .
3. For  $i > 1$ , the second half of  $a^{(i)}$  ( $a^{(i)}[2^{i-1}], \dots, a^{(i)}[2^i - 1]$ ) can be obtained by adding a digit 1 in front of the highest bit of each element in  $a^{(i-1)}$  and then arrange these elements **in a reversed order**.

For example:

- $a^{(1)} = [0, 1]$
- $a^{(2)} = [00, 01] + \text{rev}([10, 11]) = [00, 01, 11, 10]$
- $a^{(3)} = [000, 001, 011, 010] + \text{rev}([100, 101, 111, 110]) = [000, 001, 011, 010, 110, 111, 101, 100]$

Given  $S$  and  $k$ ,  $S_k$  is defined as:

$$S_k = \underbrace{a^{(n)}[a^{(n)}[\dots a^{(n)}[S]\dots]]}_{k \times a^{(n)}}$$

Now given  $S$  and  $k$ , you need to calculate the exact value of  $S_k$ . In this problem,  $S$  is given in the form of an  $n$ -bit binary number, possibly with leading zeros.

## Input

The first line contains two integers  $n, k$  ( $1 \leq n \leq 3 \times 10^6, 1 \leq k \leq 10^9$ ).

The second line contains a binary number  $S$  of length  $n$ . **The highest bit is on the left and the lowest bit is on the right.**

## Output

Output  $S_k$  in the form of an  $n$ -bit binary number in a single line, with **its highest bit on the left and the lowest bit on the right.**

## Example

standard input	standard output
3 5 011	010

## Note

$$a^{(3)} = [000, 001, 011, 010, 110, 111, 101, 100]$$

$$S_1 = a^{(3)}[(011)_2] = a^{(3)}[3] = 010$$

$$S_2 = a^{(3)}[(010)_2] = a^{(3)}[2] = 011$$

$$S_3 = a^{(3)}[(011)_2] = a^{(3)}[3] = 010$$

$$S_4 = a^{(3)}[(010)_2] = a^{(3)}[2] = 011$$

$$S_5 = a^{(3)}[(011)_2] = a^{(3)}[3] = 010$$