D. GukiZ and Binary Operations

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

We all know that GukiZ often plays with arrays.

Now he is thinking about this problem: how many arrays a, of length n, with non-negative elements **strictly less** then 2^l meet the following condition: ? Here operation means bitwise AND (in `Pascal` it is equivalent to `and`, in `C/C++/Java/Python` it is equivalent to `&`), operation means bitwise OR (in `Pascal` it is equivalent to , in `C/C++/Java/Python` it is equivalent to `|`).

Because the answer can be quite large, calculate it modulo m. This time GukiZ hasn't come up with solution, and needs you to help him!

Input

First and the only line of input contains four integers n, k, l, m ($2 \le n \le 10^{18}$, $0 \le k \le 10^{18}$, $0 \le l \le 64$, $1 \le m \le 10^9 + 7$).

Output

In the single line print the number of arrays satisfying the condition above modulo m.

Examples

input
2 1 2 10
output
3

input
2 1 1 3
output
1

input
3 3 2 10
output
9

Note

In the first sample, satisfying arrays are $\{1, 1\}$, $\{3, 1\}$, $\{1, 3\}$.

In the second sample, only satisfying array is $\{1, 1\}$.

In the third sample, satisfying arrays are $\{0, 3, 3\}$, $\{1, 3, 2\}$, $\{1, 3, 3\}$, $\{2, 3, 1\}$, $\{2, 3, 3\}$, $\{3, 3, 0\}$, $\{3, 3, 1\}$, $\{3, 3, 2\}$, $\{3, 3, 3\}$.