Problem B
Collatz Sum

POTYCZKI ALGORYTMICZNE

The 3rd Universal Cup, Stage 40: Potyczki. Limits: 1024 MB, 0.5 s. *21.06.2025*

We define the function f on natural numbers:

$$f(x) = \begin{cases} x/2, & \text{if } x \text{ is even,} \\ 3x+1, & \text{if } x \text{ is odd.} \end{cases}$$

Let $g(x)$ be the result of applying f to itself k times:

$$g(x) = \underbrace{f\big(f(\dots f}_{k \text{ times}}(x)\dots)\big).$$

Your task is, given N and k, to compute the sum

$$S = \sum_{x=1}^{N} g(x) \pmod{10^9+7}.$$

Input

A single line containing two integers N and k ($1 \le N \le 10^{12}$, $0 \le k \le 32$).

Output

Output a single number – the value of the sum S modulo 10^9+7.

Example

For the input:
```
10 2
```

the correct output is:
```
73
```

Whereas for the input:
```
999888777666 1
```

the correct output is:
```
990122835
```

Explanation of the examples:

In the first example, the values of the function $g(i)$ for consecutive i are: $2, 4, 5, 1, 8, 10, 11, 2, 14, 16$. Their sum is 73.

In the second example, $S = 874805371740356549439861$.