Problem G: Gnisrever Pro [Bonus]

Time Limit: 7 Sec Memory Limit: 128 MB
Submit: 55 Solved: 16
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Description

Narnal loves reversing and Fibonacci sequence. When he gets an array with length N, he would reverse the array in the intervals determined by Fibonacci sequence for K times.

Let F_n is the n-th Fibonacci number: $F_1 = F_2 = 1, F_n = F_{n-1} + F_{n-2}$ for all $n \geq 3$.

Let $s_n = F_{2n-1} \mod N$ and let $t_n = F_{2n} \mod N$.

Narnal's reversing always starts with an array of integers $A = (A[0], \ldots, A[N-1])$ where initially every $A[i]$ is equal to i. Now perform K successive operations on A, where the j-th operation consists of reversing the order of those elements in A with indices between s_j and t_j (both ends inclusive).

Finally, Narnal's happiness is defined as $R(N, K) = \sum_{i=0}^{N-1} i \times A[i]$ after K operations.

$1 \leq N \leq 10^{18}, 1 \leq K \leq 5 \times 10^5$.

Input

One line gives N and K, separated by space.

Output

One line with only $R(N, K) \mod 10^9$.

Sample Input

```
5 4
```

Sample Output

```
27
```

HINT

Consider using nodes to represent the sequences of consecutive numbers.

Using splay tree or other balanced tree data structure!

$R(5, 4) = 27$ can be seen from the following procedure:
Initial position: $(0, 1, 2, 3, 4)$

Step 1 - Reverse $A[1]$ to $A[1]$: $(0, 1, 2, 3, 4)$
Step 2 - Reverse $A[2]$ to $A[3]$: $(0, 1, 3, 2, 4)$
Step 3 - Reverse $A[0]$ to $A[3]$: $(2, 3, 1, 0, 4)$
Step 4 - Reverse $A[3]$ to $A[1]$: $(2, 0, 1, 3, 4)$
$R(5, 4) = 0 \times 2 + 1 \times 0 + 2 \times 1 + 3 \times 3 + 4 \times 4 = 27$.

Also, $R(10^2, 10^2) = 246597$.