# Sum of geometric series again

In 12th of July, we gave you three algorithms of calculating the prefix sum of geometric series $\{ar^{n-1}\}$. The time complexity of Algorithm 3 is $O(\log n)$, but it is quite hard to use because it needs division ($\frac{a(r^n-1)}{\boldsymbol{r-1}}$).

And we introduced a problem that asked you to write a program to calculate the last 9 digits of $r + r^2 + \cdots + r^n$. We are going to use that problem again.

The reason we are using this problem today is because ***this problem (prefix sum of geometric series) can be defined recursively!*** There is a neat recursive relation in the function $S(r, n)$, which is defined as $(r + r^2 + \cdots + r^n) \bmod 10^9$. To obtain the time complexity $O(\log n)$, try to use the method given in the today's lecture that calculates $r^n \bmod m$.

Given two integers $r$ and $n$, please write a program that calculates the last 9 digits of $r + r^2 + \cdots + r^n$. Note that, to calculate the last 9 digits, you can always store the remainder after dividing by 1,000,000,000 for each calculation.

## Input

Your input consists of an arbitrary number of lines, but no more than 100.

Each line contains two integers $r$ $(1 \le r < 10^9)$ and $n$ $(1 \le n \le \boldsymbol{10^{18}})$.

The end of input is indicated by a line containing only the value $-1$.

## Output

For each given input line, print the last 9 digits of $r + r^2 + \cdots + r^n$. Please print **exactly** 9 digits. If the answer is shorter than 9 digits, then print zeroes in the front of the answer to make it 9 digits.

## Example

| Standard input | Standard output |
|---|---|
| 1 5<br>3 10<br>20170712 1000000000000000000<br>-1 | 000000005<br>000088572<br>109375000 |

## Time Limit

1 second.