

## E. Research

Difficulty: Medium

Time: 3 s

Memory: 1024 MB

by zhtluo

A poor PhD student is submitting his paper to the ICLR (International Conference of Lottery Research). His paper will be reviewed by 3 different reviewers randomly picked out of  $n$  reviewers relevant to his field, and will be published only if all of them recommend acceptance.

To put his theory to the test, his reviewers will buy lottery tickets based on his results and either accept or reject his paper based on whether or not they make a profit. Since each reviewer either achieves financial freedom or goes completely broke after buying lottery tickets, they won't buy any more tickets after reviewing his paper once and will keep the same decision if they get picked again.

According to his paper, there is a  $p/q$  chance that any reviewer achieves financial freedom after buying lottery tickets based on his paper. If the student is willing to submit  $k$  times until his paper is published, what is the chance his paper is accepted?

### Input

The first line contains 4 integers  $n, k, p, q$  ( $3 \leq n \leq 10^6, 1 \leq k, p, q \leq 10^9, p \leq q$ ).

### Output

It can be shown that the answer can be represented as an irreducible fraction  $a/b$  for integers  $a, b$  ( $b \neq 0$ ). Output the unique integer  $x$  ( $0 \leq x < 10^9 + 7$ ) for which  $bx = a \pmod{10^9 + 7}$ .

### Sample 1

Input

3 100 1 2

Output

125000001

#### Explanation

Here, there are 3 reviewers and you submit 100 times. On the first submission, all 3 reviewers are chosen. Since there is a half probability ( $p = 1$  and  $q = 2$ , so  $p/q = 1/2$ ) of each reviewer achieving financial freedom, the chance that all 3 of them achieve financial freedom and the paper gets accepted is  $1/8$ .

On the next 99 submissions (if needed), each of the 3 reviewers have already tested his theory, so this does not improve his chances. Hence, the answer is  $1/8$ , which is  $125000001 \pmod{10^9 + 7}$ .

### Sample 2

Input

10 10 9 10

Output

60520013

#### Explanation

After 10 submissions, the student gets his paper accepted

$$\frac{1408895614597028566729171}{1415577600000000000000000} \approx 99.5\%$$

of the time, which is  $60520013 \pmod{10^9 + 7}$ .