Find The Determinant II

In this problem you have to calculate the determinant of an N x N matrix whose entries are given by **m[i][j] = gcd(i,j)^k**, $1 \le i,j \le N$.

Here gcd(i,j) denotes the greatest common divisor of i and j.

As the determinant D can grow very large, you have to print D%1000003.

Input

First line of input consists of a single integer containing the number of test cases T (equal to around 20), each of the following T lines contain two integers N and k where N is the size of the matrix and k is the exponent.
$1 \le N \le 1000000$
$1 \le k \le 10^9$

Output

One line corresponding to each test case containing the determinant modulo 1000003 for the corresponding test case.

Example

Input:
3
4 2
2 4
4 3

Output:
288
15
10192

Note: You may want to solve DETER first, in case you havent already solved it.