

Kick Start 2016 - Round B

Sherlock and Watson Gym Secrets

Problem

Watson and Sherlock are gym buddies.

Their gym trainer has given them three numbers, **A**, **B**, and **N**, and has asked Watson and Sherlock to pick two different **positive integers** *i* and *j*, where *i* and *j* are both less than or equal to **N**. Watson is expected to eat exactly i^A sprouts every day, and Sherlock is expected to eat exactly j^B sprouts every day.

Watson and Sherlock have noticed that if the total number of sprouts eaten by them on a given day is divisible by a certain integer **K**, then they get along well that day.

So, Watson and Sherlock need your help to determine how many such pairs of (*i*, *j*) exist, where $i \neq j$. As the number of pairs can be really high, please output it modulo 10^9+7 (1000000007).

Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow. Each test case consists of one line with 4 integers **A**, **B**, **N** and **K**, as described above.

Output

For each test case, output one line containing `Case #x: y`, where *x* is the test case number (starting from 1) and *y* is the required answer.

Limits

$$1 \leq T \leq 100.$$

Time limit: 60 seconds per test set.

Memory limit: 1GB.

$$0 \leq A \leq 10^6.$$

$$0 \leq B \leq 10^6.$$

Small dataset (Test set 1 - Visible)

$$1 \leq K \leq 10000.$$

$$1 \leq N \leq 1000.$$

Large dataset (Test set 2 - Hidden)

$$1 \leq K \leq 100000.$$

$$1 \leq N \leq 10^{18}.$$

Sample

Sample Input

```
3
1 1 5 3
1 2 4 5
1 1 2 2
```

Sample Output

```
Case #1: 8
Case #2: 3
Case #3: 0
```

In Case 1, the possible pairs are (1, 2), (1, 5), (2, 1), (2, 4), (4, 2), (4, 5), (5, 1), and (5, 4). In Case 2, the possible pairs are (1, 2), (1, 3), and (4, 1). In Case 3, No possible pairs are there, as $i \neq j$.