# Observation

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|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | 2 seconds |
| Memory limit: | 512 megabytes |

As an astronomer, Alice pilots her spaceship to observe an unknown object in the universe. This object can be viewed as a point in the space in a common theoretical model since its size is significantly smaller than the viewing distance.

Building a space rectangular coordinate system centred at the object, a possible perfect observing position is such which locals at an integral point. Alice records the number of perfect observing positions whose viewing distances are equal to $d \in \mathbb{Z}$ as $f_d$.

Now, given a permitted range $[L, R]$ of viewing distance, a test coefficient $K$ and a large prime number $P$, you are asked to calculate $\left( \sum_{d=L}^{R} (f_d \text{ xor } K) \right) \pmod{P}$ to explore the risk factor.

## Input

The first line contains an integer $T$ ($1 \leq T \leq 10$) representing the number of test cases.

For each test case, an only line contains four integers $L, R, K$ and $P$ described as above, where $0 \leq L \leq R \leq 10^{13}, 0 \leq K \leq 10^{18}$, the prime number $P$ satisfies $P \leq 3 \times 10^{13}$ and $R - L + 1 \leq 10^6$.

## Output

For each test case, print a line which contains an integer representing the risk factor inquired.

## Example

| standard input | standard output |
|---|---|
| 2<br>1 1 0 11<br>1 1 1 11 | 6<br>7 |