Problem E. Observation

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 ($1 \le T \le 10$) 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 $0 \le L \le R \le 10^{13}, 0 \le K \le 10^{18}$, the prime number P satisfies $P \le 3 \times 10^{13}$ and $R - L + 1 \le 10^6$.

Output

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

Example

standard input	standard output
2 1 1 0 11 1 1 1 11	6 7