Computational Complexity

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Mr. Ham learned about computational complexity in the algorithm course. Let $T(n)$ be the time the algorithm takes to run on input size n. For example, for the merge sort algorithm, we have the following recursion equation,

$$T(n) = 2T\left(\left\lfloor \frac{n}{2} \right\rfloor\right) + O(n).$$

And we can get the upper bound $T(n) = O(n \log n)$ from the algorithm textbook.

Mr. Ham is a good kid who loves to learn and explore, so he decided to try a harder problem. Consider two algorithms $A_1(n)$ and $A_2(n)$ that call each other. They satisfy the following calling relationship:

$$A_1(n) \text{ calls } A_2\left(\left\lfloor \frac{n}{2} \right\rfloor\right), A_2\left(\left\lfloor \frac{n}{3} \right\rfloor\right), A_2\left(\left\lfloor \frac{n}{5} \right\rfloor\right) \text{ and } A_2\left(\left\lfloor \frac{n}{7} \right\rfloor\right),$$

$$A_2(n) \text{ calls } A_1\left(\left\lfloor \frac{n}{2} \right\rfloor\right), A_1\left(\left\lfloor \frac{n}{3} \right\rfloor\right), A_1\left(\left\lfloor \frac{n}{4} \right\rfloor\right) \text{ and } A_1\left(\left\lfloor \frac{n}{5} \right\rfloor\right),$$

Mr. Ham wants to know the precise time taken by both algorithms.

The problem can be formally stated as follows:

Let $f(n)$ be the number of operations required by $A_1(n)$, and $g(n)$ be the number of operations required by $A_2(n)$. They satisfy the following recursion relationship

$$f(n) = \max\left(n, g\left(\left\lfloor \frac{n}{2} \right\rfloor\right) + g\left(\left\lfloor \frac{n}{3} \right\rfloor\right) + g\left(\left\lfloor \frac{n}{5} \right\rfloor\right) + g\left(\left\lfloor \frac{n}{7} \right\rfloor\right)\right),$$

$$g(n) = \max\left(n, f\left(\left\lfloor \frac{n}{2} \right\rfloor\right) + f\left(\left\lfloor \frac{n}{3} \right\rfloor\right) + f\left(\left\lfloor \frac{n}{4} \right\rfloor\right) + f\left(\left\lfloor \frac{n}{5} \right\rfloor\right)\right).$$

Given the values of $f(0), g(0)$ and m, Mr. Ham wants to know what $f(m)$ and $g(m)$ are, and the result is **modulo** M.

Note that $\lfloor x \rfloor$ represents the largest integer not exceeding x, such as $\lfloor 0.5 \rfloor = 0$, $\lfloor 11.3 \rfloor = 11$, $\lfloor 101.9 \rfloor = 101$, $\lfloor 99 \rfloor = 99$, $\lfloor 0 \rfloor = 0$, $\lfloor 2 \rfloor = 2$.

Input

The first line contains four numbers, namely $f(0)$, $g(0)$, T, M $(0 \le f(0), g(0), T \le 10^5, 2 \le M \le 10^{15})$,

Each of the next T lines contains a integer m $(0 \le m \le 10^{15})$ querying the values of $f(m)$ modulo M and $g(m)$ modulo M.

Output

Output T lines, each line contains two numbers $f(m)$ modulo M and $g(m)$ modulo M, separated by spaces.

Examples

standard input	standard output
1958 920 10 100000000000 0 1 2 3 10 100 200 1000 19580920 20232023	1958 920 3680 7832 10592 9554 17504 11276 50294 64826 784112 893714 1894550 1905470 12057866 12979424 71481494756 48626708512 28127864908 7251681354
0 0 10 100000000000 0 1 2 3 4 10 20 30 40 100	0 0 1 1 2 2 3 3 4 4 11 12 25 26 41 41 55 58 162 172