Project Euler #220: Heighway Dragon

Let D_0 be the two-letter string "Fa". For $n \geq 1$, derive D_n from D_{n-1} by the string-rewriting rules:

$$"a" \rightarrow" aRbFR"$$
$$"b" \rightarrow" LFaLb"$$

Thus, D_0 = "Fa", D_1 = "FaRbFR", D_2 = "FaRbFRRLFaLbFR", and so on.

These strings can be interpreted as instructions to a computer graphics program, with "F" meaning "draw forward one unit", "L" meaning "turn left 90 degrees", "R" meaning "turn right 90 degrees", and "a" and "b" being ignored. The initial position of the computer cursor is $(0,0)$, pointing up towards $(0,1)$.

Then D_n is an exotic drawing known as the $Heighway\ Dragon$ of order n. For example, D_{10} is shown below; counting each "F" as one step, the highlighted spot at $(18,16)$ is the position reached after 500 steps.
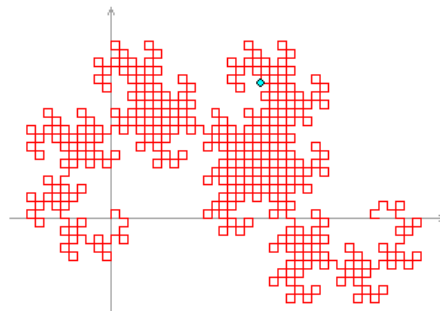
What is the position of the cursor after m steps in D_n?

Input Format

First line of each test file contains a single integer q that is the number of queries per test file. q blocks of 2 lines follow, the first of which contains a single integer n and the second contains a single integer m. Note, that while n is given in decimal, m is given in hexadecimal.

Constraints

- $1 \leq q \leq 100$

- $1 \leq n \leq 10^6$

- Sum of all n per test file $\leq 10^6$

- $1 \leq m \leq$ number of moves in D_n

- All characters in representation of m are in $\{0-9, A-F\}$

Output Format

Print exactly two lines per each query. In the first line print the x-coordinate of the cursor and in the second line print the y-coordinate of the cursor. As m from input, these numbers should also be in hexadecimal.