Toilets

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	512 mebibytes

There is an office in the form of a circle of length L. There are several toilets located in different places in the office. Each employee has a predetermined time t_i when they get up from their workplace with coordinate p_i on the circle and start walking around the office at a unit speed in a predetermined direction until they find an available toilet, after which they will occupy it for a duration of d_i. If an employee encounters an occupied toilet, they will pass by it. In the event that multiple employees simultaneously reach an available toilet, it will be occupied by the employee who started their journey earlier (it is guaranteed that t_i are monotonically increasing). A toilet can be occupied by the next employee at the same time when the previous one vacates it.

For each employee, find when and to which toilet they will get.

Input

The first line contains three numbers n, m, and L ($1 \le n, m, \le 2 \cdot 10^5$, $1 \le L \le 10^{12}$): the number of employees, the number of toilets, and the length of the office, respectively.

The second line contains m numbers x_i ($0 \le x_i < L$): the coordinates of the toilets. It is guaranteed that all x_i are distinct.

The following n lines describe the employees, one per line. Each employee is described by four values t_i, p_i, s_i, d_i ($0 \le t_i < 10^{18}$, $0 \le p_i < L$, $1 \le d_i \le 10^{12}$, $t_i < t_{i+1}$). The character s_i is either "+" or "-" (without quotes) depending on whether the i-th employee moves in the direction of increasing or decreasing coordinates. It is guaranteed that all input numbers are integers.

Output

Output n lines, each containing two numbers. The i-th line should contain the coordinate of the toilet that the i-th employee will occupy and the time when it will happen.

Example

standard input	*standard output*
5 3 45 10 20 30 0 0 + 200 2 5 + 10 20 40 - 100 21 16 + 10 50 0 + 22	20 20 10 7 30 30 10 60 10 105