



Garden 3

The JOI-Garden has a rectangular shape divided into a grid of H rows and W columns. The cell in the i -th row from the top and the j -th column from the left is called cell (i, j) .

When rain falls on a cell, the moisture level of that cell increases. The moisture level of a cell never changes except when it rains. If the moisture level of a cell becomes at least X , the cell turns into mud, which is dangerous. Therefore, every morning, JOI-kun, the manager of the JOI-Garden, may designate at most one rectangular off-limits area that contains all cells whose moisture level is at least X . More precisely, JOI-kun chooses four integers u, d, l, r ($1 \leq u \leq d \leq H$, $1 \leq l \leq r \leq W$), and the rectangular region consisting of all cells (i, j) satisfying $u \leq i \leq d$ and $l \leq j \leq r$ becomes off-limits.

Initially, the moisture level of every cell in the JOI Garden is 0.

Starting today, it will rain once every evening for N days. On the evening of the $(k - 1)$ -th day after ($1 \leq k \leq N$), rain falls on every cell (i, j) satisfying $U_k \leq i \leq D_k$ and $L_k \leq j \leq R_k$, and the moisture level of each such cell increases by C_k .

For each $k = 1, 2, \dots, N$, write a program that computes the minimum possible number of cells contained in the off-limits area that JOI-kun sets on the morning of the k -th day after.



Input

Read the following data from the standard input.

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H W N X
U1 D1 L1 R1 C1
U2 D2 L2 R2 C2
⋮
UN DN LN RN CN
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Output

Write N lines to the standard output. The k -th line ($1 \leq k \leq N$) of the output should contain the minimum possible number of cells contained in the off-limits area that JOI-kun sets on the morning of day k .

Constraints

- $1 \leq H \leq 10^9$.
- $1 \leq W \leq 10^9$.
- $1 \leq N \leq 200\,000$.
- $1 \leq X \leq 2 \times 10^{14}$.
- $1 \leq U_k \leq D_k \leq H$ ($1 \leq k \leq N$).
- $1 \leq L_k \leq R_k \leq W$ ($1 \leq k \leq N$).
- $1 \leq C_k \leq 10^9$ ($1 \leq k \leq N$).
- Given values are all integers.

Subtasks

1. (3 points) $X = 1$.
2. (24 points) $W = 1$.
3. (15 points) $N \leq 300$.
4. (30 points) $N \leq 5\,000$.
5. (28 points) No additional constraints.



Sample Input and Output

Sample Input 1	Sample Output 1
3 3 5 10	0
3 3 1 1 5	1
1 3 1 2 7	1
1 3 3 3 4	6
1 1 1 2 12	9
3 3 3 3 6	

The following is one example of how the moisture levels increase each day and how the off-limits area can be chosen so that the number of contained cells is minimized.

- On the evening of day 0, the moisture level of cell (3, 1) increases by 5. On the morning of day 1, there are no cells whose moisture level of at least 10, so no off-limits area is set.
- On the evening of day 1, the moisture level of cells (1, 1), (1, 2), (2, 1), (2, 2), (3, 1), and (3, 2) each increase by 7. On the morning of day 2, cell (3, 1) has moisture level of at least 10. JOI-kun chooses $u = d = 3$ and $l = r = 1$, thereby setting a off-limits area that contains 1 cell.
- On the evening of day 2, the moisture level of cells (1, 3), (2, 3), and (3, 3) each increase by 4. On the morning of day 3, cell (3, 1) has moisture level of at least 10. JOI-kun chooses $u = d = 3$ and $l = r = 1$, thereby setting a off-limits area that contains 1 cell.
- On the evening of day 3, the moisture level of cells (1, 1), and (1, 2) each increase by 12. On the morning of day 4, cells (1, 1), (1, 2), and (3, 1) has moisture level of at least 10. JOI-kun chooses $u = 1$, $d = 3$, $l = 1$, $r = 2$, thereby setting a off-limits area that contains 6 cells.
- On the evening of day 4, the moisture level of cell (3, 3) increases by 6. On the morning of day 5, cells (1, 1), (1, 2), (3, 1), and (3, 3) has moisture level of at least 10. JOI-kun chooses $u = 1$, $d = 3$, $l = 1$, $r = 3$, thereby setting a off-limits area that contains 9 cells.

This sample input satisfies the constraints of Subtasks 3, 4, and 5.



Sample Input 2	Sample Output 2
9 1 5 1	1
3 3 1 1 4	6
5 8 1 1 1	6
3 5 1 1 3	6
8 8 1 1 4	7
8 9 1 1 5	

This sample input satisfies the constraints of all the subtasks.

Sample Input 3	Sample Output 3
4596 9794 15 141929907	16165282
600 3070 2222 8763 472026497	19783008
47 2644 3276 6033 930213777	25583040
638 945 304 1100 992702990	25583040
370 2211 2178 2977 783902937	26266464
277 2601 1559 8989 842013671	28021036
566 3272 3124 8456 254633541	36437770
91 4241 2655 8035 303526265	36437770
1342 3662 3909 7175 685435928	36437770
1176 4012 2827 8429 614977118	36437770
255 2461 1482 5835 794902067	36437770
982 2314 941 3952 342731056	36437770
1603 2215 6730 7105 332440107	41864676
2301 4568 6898 9561 591652619	41864676
124 2097 3520 8882 168525684	41864676
1845 3599 5592 7145 555656973	

This sample input satisfies the constraints of Subtasks 3, 4, and 5.