Path of Light

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	1024 megabytes

Through the encoding and decoding methods passed down from beyond time, the scattered records have begun to take a new form.

Though still incomplete, Brue has begun to interpret scenes from the island's past.

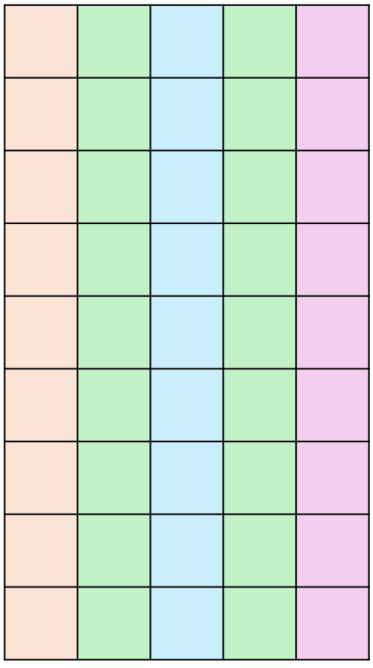
Long ago, a radiant light began to flow from the heart of the island. But it was no ordinary light — it carried order and balance, a force that revealed the principles of the world.

To maintain harmony, the ancient people attempted to control the colors of the flowing light. They believed that guiding the light's color would guide the world toward peace.

Witness the memory of the day the light first flowed, and uncover the reason why it split into light and shadow.

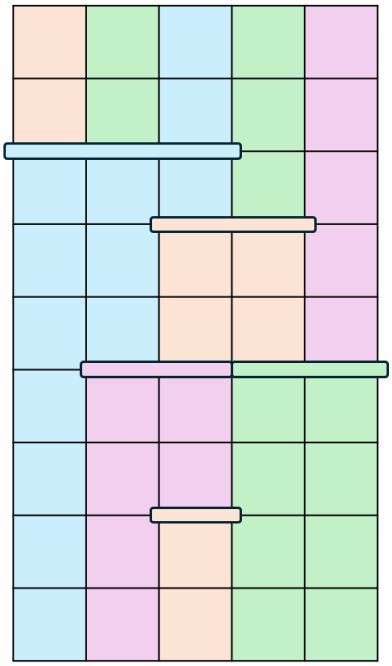
The light flows through a space represented as a grid with N rows and M columns. Light starts from the first row and flows straight down vertically to the N-th row. The cell at the r-th row from the top and c-th column from the left is denoted as (r, c).

Each column begins with a beam of light of a specific color, represented as an integer between 1 and T, inclusive. The light in column i begins with color A_i and, unless altered, continues straight downward, filling every cell in that column with the same color.



To balance the flow of light, ancient engineers placed K artifacts within the grid. Each artifact spans a continuous range of columns and lies between two consecutive rows. An artifact modifies the color of the light passing through it into a new specific color.

These artifacts do not overlap, though their ends may touch. Each artifact changes the color of any light passing through it to its designated color.



Your task is to calculate the total number of cells filled with each of the T colors.

Input

The first line contains four space-separated integers—N and M, denoting the size of the space, K, denoting the number of artifacts, and T, denoting the number of colors.

The second line contains M space-separated integers $a_1, a_2, \cdots, a_M$, denoting the initial color of the light in each column.

The following K lines each contain four space-separated integers r_i, s_i, e_i, c_i. This means that the i-th artifact is placed on the grid line between row $r_i - 1$ and row r_i, and spans the columns from s_i to e_i (inclusive). The artifact changes the color of the light passing through it to color c_i.

- $2 \leq N \leq 10^9$
- $2 \leq M \leq 2 \times 10^5$
- $1 \leq T \leq 2 \times 10^5$
- $0 \leq K \leq 2 \times 10^5$
- $1 \leq a_i \leq T$ $(1 \leq i \leq M)$
- $2 \leq r_i \leq N$ $(1 \leq i \leq K)$
- $1 \leq s_i \leq e_i \leq M$ $(1 \leq i \leq K)$
- $1 \leq c_i \leq T$ $(1 \leq i \leq K)$
- If $i \neq j, r_i = r_j$, then either $e_i < s_j$ or $e_j < s_i$ holds. $(1 \leq i \leq K, 1 \leq j \leq K)$
- All values in the input are integers.

Output

For each color from 1 to T, output the number of cells filled with that color in order, all on one line, separated by spaces.

Scoring

- Subtask 1 (3 points): $K = 0$
- Subtask 2 (8 points): $K = 1$
- Subtask 3 (19 points): $N \leq 100, M \leq 100, K \leq 100$
- Subtask 4 (25 points): $N \leq 2000, M \leq 2000, K \leq 2000$
- Subtask 5 (6 points): $N \leq 3000, M \leq 3000$
- Subtask 6 (39 points): No additional constraints.

Examples

standard input	standard output
9 5 4 5 1 2 3 2 4 3 1 3 3 6 4 5 2 6 2 3 4 4 3 4 1 8 3 3 1	8 13 13 11
7 6 3 1 1 2 3 2 3 2 5 3 5 1	16 18 8