

Problem H. Maximum Difference

Input file: **standard input**
Output file: **standard output**
Time limit: 7 seconds
Memory limit: 1024 megabytes

For an array B , define its **score**, denoted by $\text{score}(B)$, as follows.

Start with a variable $X = 0$.

In one operation, choose a non-empty subsequence[†] S of the current array B . Then:

- Update $X \leftarrow \max(X, \max(S) - \min(S))$;
- Sort the elements of S in non-decreasing order;
- Write the sorted elements back to the same chosen positions of B .

You may apply operations any number of times.

The value $\text{score}(B)$ is the minimum possible final value of X such that, after some sequence of operations, the whole array B becomes non-decreasing.

You are given an array A of length N .

You are also given M updates. In each update, two integers P and Y are given, and you must set $A_P = Y$. The updates are persistent.

After each update, output $\text{score}(A)$ for the current array.

[†] A sequence S is a subsequence of a sequence C if S can be obtained from C by deleting several, possibly zero or all, elements from arbitrary positions.

Input

The input is given in the following format:

T
$N M$
$A_1 A_2 \cdots A_N$
$P_1 Y_1$
\vdots
$P_M Y_M$
\vdots

- All input values are integers.
- $1 \leq T \leq 10^4$
- $1 \leq N, M \leq 5 \times 10^5$
- $1 \leq A_i \leq N$
- $1 \leq P_i \leq N$
- $1 \leq Y_i \leq N$
- It is guaranteed that the sum of N over all test cases does not exceed 5×10^5 .
- It is guaranteed that the sum of M over all test cases does not exceed 5×10^5 .

Output

For each test case, after each update, print one integer on a separate line — the value of $\text{score}(A)$ after applying this update.

Examples

standard input	standard output
2	3
4 4	0
4 4 1 3	2
4 4	1
3 4	1
3 2	
2 3	
6 1	
2 1 4 4 4 5	
3 5	

Note

Test case 1: After the first update, the array becomes $[4, 4, 1, 4]$, and the answer is 3.

In the same test case, after the second update, the array becomes $[4, 4, 4, 4]$, which is already sorted, so the answer is 0.

Test case 2: After the only update, the array becomes $[2, 1, 5, 4, 4, 5]$, and the answer is 1.