Division Versus Addition

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 megabytes

For an array $b = [b_1, b_2, \ldots, b_m]$ of length m ($b_i \geq 2$), consider the following two-player game played by Poby and Rekkles.

- The players take turns, with Poby moving first.
- On Poby's turn, he must choose an element $x \geq 2$ and replace it with $\left\lfloor \frac{x}{2} \right\rfloor$. In other words, he picks i ($1 \leq i \leq m$) such that $b_i \geq 2$, then does $b_i := \left\lfloor \frac{b_i}{2} \right\rfloor$.
- On Rekkles' turn, he must choose an element $x \geq 2$ from the array b and replace it with $x + 1$. In other words, he picks i ($1 \leq i \leq m$) such that $b_i \geq 2$, then does $b_i := b_i + 1$.

The game ends once all elements in the array b are equal to 1.

Define the **score** of the game as the number of moves that Poby makes. Poby's goal is to minimize the **score**, while Rekkles's goal is to maximize the **score**.

Then, the **value** of the array b is the score of the game when both players play optimally.

You are given an integer array a of length n ($a_i \geq 2$).

Answer q independent queries. In each query, you are given a range $1 \leq l \leq r \leq n$ and must find the **value** of the array $[a_l, a_{l+1}, \ldots, a_r]$.

Input

Each test contains multiple test cases. The first line contains the number of test cases t ($1 \leq t \leq 10^4$). The description of the test cases follows.

The first line of each test case contains two integers n and q ($1 \leq n, q \leq 250\,000$) — the length of the array and the number of queries.

The next line contains n integers $a_1, a_2, \ldots, a_n$ ($2 \leq a_i \leq 10^9$) — the elements of the array a.

Then q lines follow. The j-th of them contains two integers l_j and r_j ($1 \leq l_j \leq r_j \leq n$) — the range of the subarray for the i-th query.

It is guaranteed that the sum of n over all test cases does not exceed 250 000.

It is guaranteed that the sum of q over all test cases does not exceed 250 000.

Output

For each test case, output q lines. The i-th line should contain a single integer representing the answer to the i-th query.

Example

standard input	standard output
2 5 5 4 3 2 5 6 1 1 1 2 2 4 3 5 1 5 10 1 314 159 265 358 979 323 846 264 338 327 1 10	2 3 5 6 10 91

Note

Explanation of the first test case, first query (1 1):

The subarray is [4].

1. Poby: $4 \to \left\lfloor \frac{4}{2} \right\rfloor = 2$. The array is [2].
2. Rekkles: $2 \to 3$. The array is [3].
3. Poby: $3 \to \left\lfloor \frac{3}{2} \right\rfloor = 1$. The array is [1], so the game ends.

It can be shown that this strategy is optimal for both players. Therefore, the value of the array [4] is 2.

Explanation of the first test case, second query (1 2):

The subarray is $[4, 3]$.

1. Poby: $3 \to \left\lfloor \frac{3}{2} \right\rfloor = 1$. The array is $[4, 1]$.
2. Rekkles: $4 \to 5$. The array is $[5, 1]$.
3. Poby: $5 \to \left\lfloor \frac{5}{2} \right\rfloor = 2$. The array is $[2, 1]$.
4. Rekkles: $2 \to 3$. The array is $[3, 1]$.
5. Poby: $3 \to \left\lfloor \frac{3}{2} \right\rfloor = 1$. The array is $[1, 1]$, so the game ends.

It can be shown that this strategy is optimal for both players. Therefore, the value of the array $[4, 3]$ is 3.