IOI Training Camp 2017 Practice Test 1

Baba and Bitmasks

Baba was asked to teach bitmasks to the first years but he himself is not confident with bit operations. He decided to consult his friend Pandey who gave him this very hard problem on bit operations to solve first:

Given an array A containing N integers, consider all possible subarrays of the form $[L, R]$ where $(1 \leq L \leq R \leq N)$ and compute the following function f defined as follows :

$$f(L, R) = (M_1(L, R)|M_2(L, R))^2 - (M_1(L, R)\&M_2(L, R))^2$$

where $M_1(L, R)$ = min element in the subarray $[L, R]$,
$M_2(L, R)$ = second min element in the subarray $[L, R]$ (Note that M_1 and M_2 could be equal),
$|$ is bitwise OR, and
$\&$ is bitwise AND.

Find the max value that the function f can attain over all possible subarrays of the given array. Baba has no clue how to approach this problem. Can you help him ?

Input

First line will contain single integer t denoting the number of test cases.
Next $2 * t$ lines describe the test cases in the following format.
First line depicts a single integer N denoting number of elements in the array A.
The next line contains N space separated integers, where the i-th integer denotes the value of A_i .

Output

For every test case, output a single integer, the maximum value that the function f can attain.

General Constraints

Unless otherwise mentioned, the following constraints are met throughout all subtasks:

- $1 \leq t \leq 10^5$
- $1 \leq N \leq 10^6$
- $1 \leq A_i \leq 10^9$
- Sum of n over all test files $\leq 10^6$.

Subtasks

Subtask 1 (10 Points):

- $1 \leq t \leq 10$
- $1 \leq n \leq 200$

Subtask 2 (20 Points):

- $1 \leq t \leq 20$

- $1 \leq n \leq 2000$

Subtask 3 (70 Points):

- Original constraints.

Sample Input 1

```
3
3
2 3 3
4
5 4 3 15
5
3 2 6 8 3
```

Sample Output 1

```
5
216
196
```

Explanation

In the first testcase, there are 6 possible subarrays. The function is maximized in two of these subarrays: [1,2] and [1,3]. Let us look at [1,3]:
This subarray contains the elements 2, 3 and 3. Therefore, $M_1(1,3) = 2$ and $M_2(1,3) = 3$. So, the function is:

$$f(1,3) = (2|3)^2 - (2\&3)^2$$

2 is (0010) in binary, and 3 is (0011) in binary. Hence 2|3 is ((0|0)(0|0)(1|1)(0|1)), which is (0011), which is equal to 3 in decimal.
Similarly, 2&3 = ((0&0) (0&0) (1&1) (0&1)), which is (0010), which is 2 in decimal.
Hence $f(1,3) = 3^2 - 2^2 = 5$.

Limits

Time: 2 seconds

Memory: 128 MB