

Haitang and XOR Mex

Input file: **standard input**
Output file: **standard output**
Time limit: 7 seconds
Memory limit: 512 megabytes

Haitang defines the mex of a non-negative integer sequence is the smallest non-negative integer that does not belong to the array. For example, $\text{mex}([0, 1, 3]) = 2$.

Haitang defines the xormex of a non-negative integer sequence as the maximum value of the mex of the sequence after each element is XORed with the same non-negative integer. for example, $\text{xormex}([8, 9, 11]) = \text{mex}([8 \oplus 9, 9 \oplus 9, 11 \oplus 9]) = \text{mex}([1, 0, 2]) = 3$.

Given a **permutation** a of length 2^n and m queries, each query consisting of two integers l_i and r_i , you need to calculate the sum of the xormex of the subarrays $[a_x, a_{x+1}, \dots, a_y]$ for all $l_i \leq x \leq y \leq r_i$.

Input

The first line contains two integers n and m ($1 \leq n \leq 18, 1 \leq m \leq 10^6$) — the size of the permutation and the number of queries.

The second line contains 2^n integers a_i ($0 \leq a_i < 2^n$) — the permutation a .

The next m lines each contain two integers l_i and r_i ($1 \leq l_i \leq r_i \leq 2^n$) — the segment $[l_i, r_i]$ of this query.

Output

Output m lines, each containing an integer — the answer to i -th query.

Examples

standard input	standard output
2 4	9
3 2 0 1	3
1 3	4
2 3	19
1 2	
1 4	
3 5	93
0 4 6 7 5 2 1 3	9
1 8	29
3 5	22
2 6	15
3 7	
1 4	