Problem F. Suffix Array for Thue-Morse

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

A Thue-Morse string of order k is a string of length 2^k in which i-th symbol equals to '`A`' if the number of 1-bits in binary representation of $i - 1$ is even, and '`B`' if it is odd.

A suffix array for string s of length n is a permutation suf of integers from 1 to n such that $s[suf[1]..n]$, $s[suf[2]..n]$, ..., $s[suf[n]..n]$ is the list of non-empty suffixes of s sorted in lexicographical order.

Let suf be the suffix array for Thue-Morse string of order k. You task is to calculate q values: $suf[p_1]$, $suf[p_2]$, ..., $suf[p_q]$.

Input

The first line of input contains two integers k and q: the order of Thue-Morse string and the number of queries ($0 \le k \le 60$, $1 \le q \le 10^5$).

The second line contains q integers p_1, p_2, ..., p_q separated by spaces: the required indices ($1 \le p_i \le 2^k$).

Output

Output q answers to the queries, separated by spaces.

Example

standard input	standard output
3 8 1 2 3 4 5 6 7 8	6 7 4 1 8 5 3 2

Note

Thue-Morse string of order 3 is "`ABBABAAB`".