Circular Convolution 2

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	1024 megabytes

After winning the *Best Paper Award* at *the 5202 annual IEEE Symposium on Foundations of Computer Science (FOCS)* by solving the $(\min, +)$-convolution problem in $O(n^{1.999})$, Little Cyan Fish wants you to solve the following problem.

Little Cyan Fish defines the $(\min, +)$ circular convolution of two sequences $a_0, a_1, \cdots, a_{n-1}$ and $b_0, b_1, \cdots, b_{n-1}$ of length n as another sequence $a \times b$ such that:

$$(a \times b)_k = \min_{(i+j) \equiv k \pmod{n}} (a_i + b_j)$$

For a positive integer t, Little Cyan Fish defines the t-th power of a sequence $a_0, a_1, \cdots, a_{n-1}$ as follows:

$$a^t = \begin{cases} a & t = 1 \\ a^{t-1} \times a & t > 1 \end{cases}$$

Now, Little Cyan Fish gives you a **randomly generated** sequence $a_0, a_1, \cdots, a_{n-1}$ of length n. He wants you to calculate the sequence a^n, i.e. $\underbrace{a \times a \times \cdots \times a}_{n \text{ times}}$.

Input

The first line of the input contains a single integer n ($1 \le n \le 5 \times 10^5$).

The next line of the input contains n integers $a_0, a_1, \cdots, a_{n-1}$ ($1 \le a_i \le 10^9$), indicating the sequence.

It is guaranteed that each element of $\{a_n\}$ is generated by choosing an integer from 1 to 10^9 **independently and uniformly at random**. There are no more than 100 test cases (including the examples) in this problem.

Output

Output a single line containing n integers $c_0, c_1, \cdots, c_{n-1}$, indicating the answer.

Examples

standard input	standard output
2 82688973 409689707	165377946 492378680
3 965805101 983238551 643391778	1930175334 2252588657 2270022107