

Max-Heap Construction by Multiple Insertions (20 pts)

Problem Description

Given an array A that contains N distinct elements, we can call $\text{MAX-HEAP-INSERT}(A, A[n])$ for $n = 1, 2, \dots, N$ to convert A into a max heap. Although constructing the heap by those insertions may not be the fastest approach (check the textbook for faster ways!), it is somewhat simpler for you to understand and implement. :-) The MAX-HEAP-INSERT algorithm, as listed in the textbook, is

$\text{MAX-HEAP-INSERT}(A, key)$

- 1 $A.heapsize = A.heapsize + 1$
- 2 $A[A.heapsize] = -\infty$
- 3 $\text{HEAP-INCREASE-KEY}(A, A.heapsize, key)$

The MAX-HEAP-INSERT algorithm calls HEAP-INCREASE-KEY to float the new key up. We strongly believe that you should know how to implement $\text{PARENT}(i)$ from our lecture. :-)

$\text{HEAP-INCREASE-KEY}(A, i, key)$

- 1 $A[i] = key$
- 2 **while** $i > 1$ **and** $A[\text{PARENT}(i)] < A[i]$
- 3 $\text{SWAP}(A[\text{PARENT}(i)], A[i])$
- 4 $i = \text{PARENT}(i)$

Please output the resulting max heap after the N insertions.

Input

The first line contains the number N . The second line contains N positive integers separated by spaces, representing the initial $A[1], A[2], \dots, A[N]$.

Output

Output the array-represented max-heap after N insertions within a line, separating each number by a space.

Constraint

- $1 \leq N \leq 10^6$
- $1 \leq A[n] \leq 10^9$
- All $A[n]$ are distinct.

Sample Testcases

Sample Input 1

2
1 3

Sample Output 1

3 1

Sample Input 2

4
8 9 6 4

Sample Output 2

9 8 6 4

Sample Input 3

4
9 8 4 6

Sample Output 3

9 8 4 6

Sample Input 4

4
6 8 4 9

Sample Output 4

9 8 4 6

Hint

- By design, you can pass this homework by simulating the algorithms properly. There is no need for other arithmetic calculations or cuts.