Lab 01
Sorting

CSE 4404
ALGORITHMS LAB

NOVEMBER 22, 2021

1 Find the k^{th} largest element

Let's say you have an array of n integers $a_1, a_2, ..., a_n$. The array is unsorted.Find the kth largest in this array.

Input

The first line contains two integers n and k ($1 \leq n \leq 10^5, 1 \leq k \leq n^2$). The second line contains the array containing n integers $a_1, a_2, ..., a_n (-10^5 \leq a_i \leq 10^5)$. The numbers in the array might not be distinct.

Output

In the single line print the k-th largest element of the array .

Example

Sample Input 1	Sample Output 1
10 4 3 1 5 11 4 9 15 20 2 23	4

2 Find The Median

Median plays an important role in the world of statistics. By definition, it is a value which divides an array into two equal parts. In this problem you are to determine the current median of some long integers. Suppose, we have five numbers $1, 3, 6, 2, 7$. In this case, 3 is the median as it has exactly two numbers on its each side. $1, 2$ and $6, 7$. If there are even number of values like $1, 3, 6, 2, 7, 8$, only one value cannot split this array into equal two parts, so we consider the average of the middle values $3, 6$. Thus, the median will be $(3 + 6)/2 = 4.5$. In this problem, you have to print only the integer part, not the fractional. As a result, according to this problem, the median will be 4 !

Input

The input consists of a series of integers $X (0 < X < 10^9)$. You may safely assume that the total number of integers will be less than 1000.

Output

For each input print the current value of the median.

Example

Sample Input 1	Sample Output 1
1 3 4 60 70 50 2	1 2 3 3 4 27 4

Task 2.1

Find a suitable solution of the given problem. Write your own sorting function.

3 Find the k^{th} Largest Pair

Let's say you have an array of n integers $a_1, a_2, ..., a_n$. You need to make pairs from these numbers (a_i, a_j) such that $(1 \leq i, j \leq n)$ and sort them lexicographically in non-decreasing order. A pair (p_1, q_1) is lexicographically less than the pair (p_2, q_2) if either $p_1 < p_2$, or $p_1 = p_2$ and $q_1 < q_2$. As there are n integers in the array, you will have a total of n^2 pairs. Let's number them from 1 to n^2. Your task is to find the k-th pair from the lexicographically sorted list of pairs.

Input

The first line contains two integers n and k $(1 \leq n \leq 10^5, 1 \leq k \leq n^2)$. The second line contains the array containing n integers $a_1, a_2, ..., a_n (-10^5 \leq a_i \leq 10^5)$. The numbers in the array might not be distinct.

Output

In the single line print two numbers of the k-th pair.

Example

Sample Input 1	Sample Output 1
3 2 3 1 5	1 3

Sample Input 2	Sample Output 2
4 11 1 1 3 3	3 1

Explanation

In the first sample, the list of pairs will be $(3,3), (3,1), (3,5), (1,3), (1,1), (1,5), (5,3), (5,1), (5,5)$. After you sort these pairs, the list becomes $(1,1), (1,3), (1,5), (3,1), (3,3), (3,5), (5,1), (5,3), (5,5)$. So, the 2-nd pair is $(1,3)$ which is the same as the given output.

Task 3.1

Find a $O(n^2)$ solution of the given problem. you are not allowed to use any kinds of built in sorting library. If you need to perform any kinds of sorting, write a custom function for that.

Task 3.2

Find a $O(n \log n)$ solution of the given problem. you are not allowed to use any kinds of built in sorting library. If you need to perform any kind of sorting, write a custom function for that.