

# Algorithms: Programming Assignment One

Deadline: Oct 5, 2020

1. Write a program that accepts two integers  $n, k$  and finds  $\lfloor n^{\frac{1}{k}} \rfloor$ . The algorithm behind your program should run in time polynomial in  $\log n$ . Math libraries are not allowed.

Input format: The first line of the input consists of a number  $t \geq 1$  of test cases. Each subsequent line consists of pairs  $n, k$  separated by a space. An example is given below.

Sample Input:

```
3
64 3
15 2
10 5
```

Sample Output:

```
4
3
1
```

Constraints:  $1 \leq n \leq 10^{16}, 1 \leq k \leq n$ .

2. Given an array  $A[1, 2, \dots, n]$  of distinct elements, an inversion is a pair  $(i, j)$  of indices such that  $i < j$  and  $A[i] > A[j]$ . Eg: The sequence 3,8,0,-4,1 has 7 inversions, namely the pairs (1,3), (1,4), (1,5), (2,3), (2,4), (2,5), (3,4).

Write a program to count the number of inversions of a given array. The algorithm behind your input should run in  $O(n \log n)$  time.

Input format: The first line of the input consists of a single integer:  $n$ , the number of elements in the array. The second line of the input consists of the elements of the array, separated by a space.

Sample Input:

5

3 8 0 -4 -1

Sample Output:

7

Constraints:  $n \leq 10^5$ .