Date: 13/01/2020

Daily Practice Sets - Data Structures

Question 1:

You want to build a temple for snakes. The temple will be built on a mountain range, which can be thought of as n blocks, where height of i-th block is given by h_i. The temple will be made on a consecutive section of the blocks and its height should start from 1 and increase by exactly 1 each time till some height and then decrease by exactly 1 each time to height 1, i.e. a consecutive section of 1, 2, 3, .. x-1, x, x-1, x-2, .., 1 can correspond to a temple. Also, heights of all the blocks other than of the temple should have zero height, so that the temple is visible to people who view it from the left side or right side.

You want to construct a temple. For that, you can reduce the heights of some of the blocks. In a single operation, you can reduce the height of a block by 1 unit. Find out minimum number of operations required to build a temple.

Input

The first line of the input contains an integer T denoting the number of test cases. The description of T test cases follows.

The first line of each test case contains an integer n.

The next line contains n integers, where the i-th integer denotes h_i

Output

For each test case, output a new line with an integer corresponding to the answer of that testcase.

Constraints

- $1 \leq T \leq 10$
- $2 \leq n \leq 10^5$
- $1 \leq h_i \leq 10^9$

Example

Input

```
3
3
1 2 1
4
1 1 2 1
5
1 2 6 2 1
```

Output

```
0
1
3
```

Explanation

Example 1. The entire mountain range is already a temple. So, there is no need to make any operation.

Example 2. If you reduce the height of the first block to 0. You get 0 1 2 1. The blocks 1, 2, 1 form a temple. So, the answer is 1.

Example 3. One possible temple can be 1 2 3 2 1. It requires 3 operations to build. This is the minimum amount you have to spend in order to build a temple.

Question 2:

You are given N integers. In each step you can choose some K of the remaining numbers and delete them, if the following condition holds: Let the K numbers you've chosen be a_1, a_2, a_3, ..., a_K in sorted order. Then, for each $i \leq K - 1$, a_{i+1} must be greater than or equal to $a_i * C$.

You are asked to calculate the maximum number of steps you can possibly make.

Input

- **The first line of the input contains an integer T, denoting the number of test cases. The description of each testcase follows.**
- **The first line of each testcase contains three integers: N, K, and C**
- **The second line of each testcase contains the N initial numbers**

Output

For each test case output the answer in a new line.

Subtasks

Subtask #1 (40 points):

- **$1 \leq N \leq 10^3$**
- **1 ≤ Sum of N over all test cases ≤ 10^3**

Subtask #2 (60 points):

- **Original constraints**

Constraints

- **$1 \leq T \leq 100$**
- **$1 \leq N \leq 3 * 10^5$**
- **$1 \leq K \leq 64$**
- **$2 \leq C \leq 50$**

- $1 \leq a_i \leq 10^{18}$
- $1 \leq$ Sum of N over all test cases $\leq 3 * 10^5$

Example

Input:
2
6 3 2
4 1 2 2 3 1
6 3 2
1 2 2 1 4 4

Output:
1
2

Explanation

Testcase 1: You can make one step by choosing {1, 2, 4}.

Testcase 2: You can make one step by choosing {1, 2, 4} and another by choosing {1, 2, 4}.

Question 3:

Chef taught his brother Chefu about right angled triangle and its properties. Chefu says that he has understood everything about right angled triangles. Chef wants to check learning of his brother by asking the following question "Can you find a right angled triangle whose length of hypotenuse is H and its area is S?"

Chefu is confused how to solve it. I hope you are not. Please solve this by finding a right angled triangle with hypotenuse H and area S. If it not possible to do so, then output -1.

Input

The first line of the input contains a single integer T denoting the number of test-cases. T test cases follow.

For each test case, there will be a single line containing two space separated integers H and S.

Output

Output the answer for each test-case in a single line. If it is not possible to find such a triangle, output -1. Otherwise print 3 real numbers corresponding to the lengths of the sides of the triangle sorted in non-decreasing order. Please note that the length of the triangle sides should not differ by more than 0.01 in absolute value from the correct lengths.

Constraints

- **$1 \leq T \leq 10^5$**
- **$1 \leq H \leq 10^6$**
- **$1 \leq S \leq 10^{12}$**

Example

Input:
4
5 6
6 10
258303 89837245228
616153 77878145466

Output:
3.00000 4.00000 5.00000
-1
-1
285168.817674 546189.769984 616153.000000

Question 4:

You are given a string S of length N consisting only of 0s and 1s. You are also given an integer K.

You have to answer Q queries. In the i^{th} query, two integers L_i and R_i are given. Then you should print the number of substrings of S[L, R] which contain at most K 0s and at most K 1s where S[L, R] denotes the substring from L^{th} to R^{th} characters of the string S.

In other words, you have to count number of pairs (i, j) of integers such that $L \le i \le j \le R$ such that no character in substring S[i, j] occurs more than K times.

Input

The first line of input contains an integer T, denoting the number of test cases. Then T test cases follow.

The first line of each test case contains three space-separated integers N, K and Q as described in the problem. The second line contains a string S of length N. Then the next Q lines describe the query, where the i^{th} line of them contains two space-separated integers L_i and R_i.

Output

For each query, print the required answer in a single line.

Constraints and Subtasks

- **$1 \le T \le 10^5$**
- **$1 \le K \le N \le 10^5$**
- **$1 \le Q \le 10^5$**
- **$1 \le L_i \le R_i \le N$**
- **Sum of N over all test cases in one test file does not exceed 10^5**
- **Sum of Q over all test cases in one test file does not exceed 10^5**
- **S consists only of 0s and 1s.**

Subtask 1: 10 points

- **Sum of N over all test cases in one test file does not exceed 100**

Subtask 2: 10 points

- **Q = 1**
- **1 ≤ K ≤ min(5, N)**

Subtask 3: 20 points

- **1 ≤ Q ≤ 10**

Subtask 4: 60 points

- **Original constraints.**

Example

Input:

1

8 2 3

01110000

1 4

2 4

5 8

Output:

8

5

7

Explanation

Query 1: Consider substring P = S[1, 4] = "0111".

Out of 10 total substrings of P, substrings P[1, 4] and P[2, 4] are not valid because both contain more than two 1s.

Other substrings contains at most two 0s and at most two 1s, thus the answer is 8.

Query 2: Consider substring P = S[2, 4] = "111".

Out of 6 total substrings of P, substrings P[1, 3] is not valid because it contains more than two 1s.

Query 3: Consider substring P = S[5, 8] = "0000".

Out of 10 total substrings of P, substrings P[1, 3], P[1, 4] and P[2, 4] are not valid because all contain more than two 0s.