CP1 [2023] Lab1

A. Nordle

1 second, 256 megabytes

Vivian likes to play Nordle, a popular word game in Hoskasia. Nordle consists of trying to guess an array A of length n consisting of positive integers, where each element is in $[1, n]$.

Say the player guesses with the array B of length n. Nordle returns a binary string S of length n, where $S_i = 1$ if $A_i = B_i$, and $S_i = 0$ otherwise.

For example, if $A = [1, 2, 3, 4]$ and the guess $B = [2, 2, 3, 1]$, Nordle returns the string $S = 0110$.

Vivian adopts the following strategy: She starts with the guess $B = [1, 1, 1, \ldots, 1]$ and reads the string S. For each index where $S_i = 0$, Vivian increments B_i by 1 for the next guess.

After the string is guessed, she wants to know how many total `0`s she got across all the strings S returned by Nordle.

Input
The first line consists of n, the length of the word to guess.
$(1 \leq n \leq 2 * 10^5)$

The next line consists of n integers, the answer to the game.
$(1 \leq a_i \leq n)$

Output
Output the total number of `0`'s Vivian will get.

input
4 4 1 3 2
output
6

Vivian starts with guess $B = [1, 1, 1, 1]$. Nordle returns the string `0100`.

In the 2nd guess, $B = [2, 1, 2, 2]$. Nordle returns the string `0101`.

In the 3rd guess, $B = [3, 1, 3, 2]$. Nordle returns the string `0111`.

In the 4th guess, $B = [4, 1, 3, 2]$. Nordle returns the string `1111`. The game is solved.

The total number of zeros in `0100`, `0101`, `0111`, and `1111` is 6.

B. The Love Story

1 second, 256 megabytes

Jayan has a deep passion for coding and enjoys communicating with Tun Tun Mausi by exchanging encoded messages. Given a string S, Jayan encodes it into the string S' by following these steps:

1. Initially, S is the input string, and S' is an empty string.
2. Pick the 'median' character from S and remove it from S. Put it at the end of S'. (The 'median' element of S is the element in its center. If S is of even length, the left of the two middle characters is the median)
3. Repeat Step 2 until S becomes an empty string.

Tun Tun Mausi does not understand this encoding scheme. When she receives the string S', she needs your help decoding to obtain the original string S.

Input
The first line contains a positive integer n $(1 \leq n \leq 10^6)$ — the length of the encoded word.

The second line contains the string S' of length n consisting of lowercase English letters — the encoded string.

Output
Print the decoded (original) string S.

input
5 daolo
output
ladoo

This is how Jayan encodes the string '`ladoo`'

Initially, S = '`ladoo`', S' = ''

After 1 iteration, S = '`laoo`', S' = '`d`'

After 2 iterations, S = '`loo`', S' = '`da`'

After 3 iterations, S = '`lo`', S' = '`dao`'

After 4 iterations, S = '`o`', S' = '`daol`'

After 5 iterations, S = '', S' = '`daolo`'

You then decode the string '`daolo`' to get '`ladoo`'.

C. Maximum Grind

1 second, 256 megabytes

As part of the CP-1 course, students are provided points for problems solved directly proportional to the rating of the problem.

Problems rated from 800 to 1099 are worth 0 points, those from 1100 to 1299 are worth 1 point, and so on, where the score keeps on increasing by 1 for every 200 rating increase.

At the end of the course, the TAs get an aggregate data of students and the problems solved by them. The data consists of n rows, where the i-th row contains a string s_i denoting the student's name, and x_i denoting the rating of the problem solved by that student.

As a student, you get access to this data (somehow) and are interested in knowing what is the maximum score obtained by any student.

Input
The first line contains n $(1 \leq n \leq 10^5)$ total number of submissions made.

The following n contain a string s $(1 \leq |s| \leq 10)$, the name of student, and an integer x $(800 \leq x \leq 3500)$, the rating of the problem.

Output
Print the highest points scored by a student.

input
5 abc 1200 def 1300 abc 1200 ghi 1000 jkl 800
output
2

Student `abc` scored $1 + 1 = 2$ points (for solving 2 problems each of rating 1200)

Student `def` scored 2 points (for solving a problem of 1300 rating)

Students `ghi` and `jkl` scored 0 points each.

The highest score by any student was 2.

D. Constrained Common Divisor

1 second, 256 megabytes

You are given 2 integers a and b, and n queries, In the i-th query, you are given integers L_i and R_i. You need to find the greatest integer d_i that

- $d_i|a$ (That is, a is divisible by d_i)
- $d_i|b$ (That is, b is divisible by d_i)
- $L_i \leq d_i \leq R_i$

Input

The first line contains two integers a and b, the two integers as described above $(1 \leq a, b \leq 10^9)$.

The second line contains one integer n, the number of queries $(1 \leq n \leq 10^4)$.

In the next n lines, the i-th line contains one query consisting of two integers, L_i and R_i $(1 \leq L_i \leq R_i \leq 10^9)$.

Output

Print n lines. The i^{th} of them should contain the result of the i^{th} query in the input. If there is no common divisor in the given range for any query, you should print -1 as a result for this query.

input
9 27 4 1 5 10 20 9 27 3 6
output
3 -1 9 3

Here, $a = 9, b = 27$

In the first query, $d_1 = 3$, as it is the greatest value such that $d_1|9$, $d_1|27$, and $1 \leq d_1 \leq 5$.

In the second query, $d_2 = -1$, as there is no value that satisfies all the 3 conditions.

E. Coin picker

1 second, 256 megabytes

Ananya wants to buy gifts for her friend, and she goes to a gift shop with n gifts. Every gift has a value a_i and a cost c_i. She can pick any two numbers l, r such that $1 \leq l \leq r \leq n$, and buy all the gifts from $[l, r]$ (She can only do this once before she has to leave). Her friend will only be happy if the total value of the gifts is greater than or equal to their happiness threshold k. Help her make her friend happy at the cheapest price possible, or report that it's impossible.

Input

The first line consists of 2 numbers n and k, the number of gifts in the shop and the happiness threshold of Ananya's friend. $(1 \leq n \leq 10^5, 1 \leq k \leq 10^9)$

The next line consists of n numbers a_i, the values of the gifts. $(1 \leq a_i \leq 10^5)$

The next line consists of n numbers c_i, their cost. $(3 * 10^5 \leq c_i \leq 3 * 10^5 + 2)$

Output

Print a single number, the minimum cost in which Ananya can make her friend happy, or -1 if it's impossible.

input
3 10 5 5 5 300000 300001 300002
output
600001

F. Bibliophilia

1 second, 256 megabytes

Athena loves to read books and wants to buy fresh books everyday to read. Luckily for her, she is on a trip to a book fair for n days! Before Athena arrives, the book fair has m books for sale, each for a particular price.

On the i-th day, the book fair adds c_i books for sale. Athena's father gives her y_i rupees, with which Athena buys the most expensive book she can buy (if any). At the end of the day, she spends any leftover money on ice-cream.

Athena's father is worried about Athena's ice-cream consumption, and wants you to calculate the total money Athena spends on ice-cream over all the n days.

You can assume that Athena is the only person buying books from the store.

Input

The first line contains $n(1 \leq n \leq 10^3)$, the number of days and $m(1 \leq m \leq 10^5)$, the number of books available at bookstore before day 1.

The next line contains m integers $x(1 \leq x \leq 10^9)$ the cost of books available before day 1.

The next $2 \times n$ lines contain the information about the books added everyday to the store and money Athena received from her father.

The first line contains 2 integers $c(1 \leq c \leq 10^5)$, the number of books added to store's collection, and $y(1 \leq y \leq 10^9)$, the amount she received from her father.

The second line contains c integers $z(1 \leq z \leq 10^9)$, the cost of every book added to collection.

The sum of c over all days is not more than 10^5

Output

Output the total money Athena spent on ice cream on all n days combined.

input
3 5 10 11 12 13 14 2 1 4 5 3 25 15 20 30 5 30 1 2 3 4 5
output
6

On the first day, the cost of books she can buy are $[4, 5, 10, 11, 12, 13, 14]$ Since she has only 1 rupee, she will not buy any book and buy an ice cream instead.

On the second day, the cost of books she can buy are $[4, 5, 10, 11, 12, 13, 14, 15, 20, 30]$. She will buy the book worth 20, and spend the remaining 5 on ice cream.

On the final day, she will similarly buy the book worth 30 rupees, and thus spend 0 on ice cream.

Thus, she spends a total of ₹6 on ice cream.