Maratona SBC de Programação 2024

This problem set is used in simultaneous contests:
Competencia Boliviana de Programación
The 2024 ICPC Gran Premio de Centroamerica
The 2024 ICPC Gran Premio de Mexico

August 31st, 2024

Warmup session

General Information

This problem set contains 4 problems; pages are numbered from 1 to 5, without considering this page. Please, make sure that your book is complete.

A) Program name
1) Solutions written in C/C++ and Python, the filename of the source code is not significant, can be any name.
2) Solutions written in Java, filename should be: *problem_code*`.java` where *problem_code* is the uppercase letter that identifies the problem. Remember in Java the main class name and the filename must be the same.
3) Solutions written in Kotlin, filename should be: *problem_code*`.kt` where *problem_code* is the uppercase letter that identifies the problem. Remember in Kotlin the main class name and the filename must be the same.

B) Input
1) The input must be read from *standard input*.
2) The input is described using a number of lines that depends on the problem. No extra data appear in the input.
3) When a line of data contains several values, they are separated by *single* spaces. No other spaces appear in the input.
4) Every line, including the last one, ends with an end-of-line mark.
5) The end of the input matches the end of file.

C) Output
1) The output must be written to *standard output*.
2) When a line of results contains several values, they must be separated by *single* spaces. No other spaces should appear in the output.
3) Every line, including the last one, must end with an end-of-line.

Problem A

Detour

In the city of Nlogonia, the mayor is taking action on his promises to revitalize the city's road infrastructure. However, the road renewal process renders certain roads temporarily impassable, requiring the establishment of detours to ensure uninterrupted traffic flow.

Each road segment connects two crossroads in the city, has a positive length and can be traversed in both directions. A detour is a designated alternative route that temporarily replaces a road segment under renewal. Specifically, when the road connecting crossroads U and V is impassable, the detour must be a sequence of roads that originates at U and terminates at V, while intentionally avoiding the direct road between U and V. The goal is to find the shortest detour for each road segment to minimize disruptions while road improvements take place.

As the Intern at the Center for Pavement and Cars, your responsibility is to support the mayor's initiative by calculating the length of the shortest detour for each road segment within the city.

Input

The first line contains two integers, N and M ($1 \leq N \leq 300$), representing the number of crossroads in the city and the number of road segments. Each of the following M lines contains three integers, U, V, and L ($1 \leq U \leq N$, $1 \leq V \leq N$, $U \neq V$, $1 \leq L \leq 10^6$), representing a two-way road segment of length L that connects crossroads U and V. No road segment is duplicated.

Output

Output M lines, each line containing an integer. The integer on the i-th line represents the shortest detour length for the i-th road segment or `-1` if there is no possible detour. The answer for each road segment should be given in the same order as road segments are described in the input.

Input example 1	**Output example 1**
4 5 1 2 4 1 3 8 2 3 4 4 1 2 3 4 3	9 5 9 11 10

Input example 2	**Output example 2**
2 1 1 2 1	-1

Problem B

Amusement Park Adventure

Meet Carlitos, a spirited adventure enthusiast with an insatiable love for amusement parks. Despite his vibrant passion, Carlitos faces a unique challenge – his height. As he eagerly plans his weekend escapade, he realizes that his vertical limitations might hinder his amusement park experience. It's not just about choosing a park; it's about finding one where he can enjoy the thrill of the rides.

Picture the kaleidoscope of colors, the jubilant laughter, and the heart-pounding rush of the rides. Carlitos has always been drawn to the energy of amusement parks. With the weekend approaching, he pores over park brochures, studying the height requirements of each ride. His goal is to maximize his enjoyment, and that's where you come in.

Your task is to help Carlitos determine the number of rides he can enjoy at a specific park. By considering his height and the minimum height requirements of each ride, guide him in making the most of his amusement park adventure.

Input

The first line contains two integers, N and H ($1 \leq N \leq 6$ and $90 \leq H \leq 200$), representing the number of rides in a park and Carlitos' height in centimeters, respectively.

The second line contains the minimum heights $A_1, \ldots, A_N$ ($90 \leq A_i \leq 200$) of each ride in the park.

Output

Output a single line with an integer indicating the number of rides Carlitos can go on, that is, the number of rides for which Carlitos' height is at least as large as the minimum height required.

Input example 1	**Output example 1**
`1 100` `100`	`1`

Input example 2	**Output example 2**
`6 120` `200 90 100 123 120 169`	`3`

Problem C

K for More, K for Less

The life of those who study computer science is not always as easy as it seems. Some days you might be implementing a revolutionary algorithm, and other days you find yourself reading the same book for the tenth time. But at all times we are looking for the same thing: to optimize and automate tasks. In this case, a teacher needs your help to guide his students to the next exam. In the professor's opinion, it is not easy to decide how much time students should spend studying theoretical topics and how much time they should spend implementing algorithms.

This is not the first time that the professor has taught this subject, so the amount of data available is so large that he was able to create two polynomials to describe the final performance of each student. If the student spends x units of his time studying theory, his grade will increase by $t(x)$. If the student spends x units of his time implementing algorithms, his grade will increase by $p(x)$. In such a way that the student who spends the same amount x of time in each of the areas will have a final grade of $t(x) + p(x)$.

Recently one of the students has been standing out unpredictably. He does not hide his technique from anyone: "I study theory a lot more than practice!". The professor believes this is a lie and, to confirm his suspicion, he decided to estimate students grades if they always studied more theory than practice (or more practice than theory). Can you compute the polynomial $q(x) = t(x+K)+p(x-K)$? It will be able to describe every student grade if they change their study strategy.

Input

The input consists of three lines. The first line contains two integers: N, representing the degree of the polynomials t and p ($1 \leq N \leq 10^5$) and K ($-10^5 \leq K \leq 10^5$). The second line contains the $N + 1$ coefficients of t, and the third line contains the $N + 1$ coefficients of p. The coefficients are given in increasing order of degree, with the last coefficient in the row corresponding to the term with degree N, all of which are non-negative with a maximum value of 10^6.

Output

Your program should print a line with $N + 1$ integers, the coefficients of the polynomial $q(x)$ in increasing order of degree modulo 998244353.

Input example 1	**Output example 1**
1 2 1 2 0 1	3 3

Input example 2	**Output example 2**
2 0 1 2 3 4 5 6	5 7 9

Input example 3	**Output example 3**
2 -1 3 3 3 1 0 0	4 998244350 3

Problem D

Fatigue-Fighting Vacation

William is planning his upcoming vacations. A recurring problem when he takes vacations is the need to deal with fatigue. Some days he does not enjoy much, as after several activities, the fatigue becomes greater than what he can deal with.

This time, William had an idea. He will estimate the impact on his disposition for each of the tourism activities. He noticed that some of the vacation activities, such as sports and hikes, are tiring and consume his disposition, while other activities, such as theatre plays and musicals, are invigorating and restore his disposition.

More precisely, William starts with D units of disposition and separates his activities into two groups: C tiring activities and R invigorating activities. Each tiring activity requires a certain amount of disposition and consumes that amount of disposition when performed. Each invigorating activity provides him with a certain amount of disposition when performed. Additionally, he arranges the activities in each group according to his preferences, as there are activities he is more willing to perform. It is important to note that activities from both sets can be interleaved, but William will never do an activity from one group without having done all the previous activities from that group, as this would not conform with his preferences.

Throughout his vacation, when deciding which activity to do next, he will choose the first untaken tiring activity, provided he has enough disposition to do it. Otherwise, he will perform the next untaken invigorating activity, if any remains, replenishing a certain amount of disposition. Naturally, if there are no remaining tiring activities at any point, he can simply perform all the remaining invigorating activities.

Considering this process, William has asked for your help to determine how many activities (including both tiring and invigorating ones) he will be able to perform.

Input

The first line of input contains three integer numbers, D, C, and, R, representing, respectively, the initial amount of disposition, the number of tiring activities, and the number of invigorating activities ($1 \leq D \leq 10^5$, $1 \leq C \leq 10^4$, and $1 \leq R \leq 10^4$). Each of the next C lines contains an integer number C_i ($1 \leq C_i \leq 10^5$ for $1 \leq i \leq C$), representing the required amount of disposition for a tiring activity, in order of preference. Finally, each of the next R lines contains an integer number R_i ($1 \leq R_i \leq 10^5$ for $1 \leq i \leq R$), representing the provided amount of disposition for an invigorating activity, in order of preference.

Output

Print a single line with a single integer number, the total number of activities (including both tiring and invigorating ones) that William will be able to perform.

Input example 1	**Output example 1**
40 3 3 30 20 10 5 5 5	5

Input example 2	**Output example 2**
40 2 2 60 80 5 10	2

Input example 3	**Output example 3**
100 3 1 60 60 50 10	2