Gran Premio de México 2020 - Tercera Fecha

This problem set is used in simultaneous contests:
Tercera Fecha Gran Premio de México 2020
Segunda Fecha Gran Premio de Centroamérica 2020

December 05th, 2020

Problems book

General Information

This problem set contains 14 problems; pages are numbered from 1 to 18, Without considering this page. Please, verify 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

Acing the contest

A common programming contest format includes teams with three contestants working to solve the maximum amount of programming challenges in the less amount of time using a single computer. Some contests have been created using a similar idea. In this contest a team has T team members, each team member has an energy E_i. The higher the energy of the member the more and the harder problems he can solve. There are a total of P programming challenges, to be solved, using a single computer. The programming challenges are numbered with numbers from 1 to P, each one having a difficulty of D_i and a score value of S_i.

The contest runs as follows, the first team member will sit in front of the computer and then the contest will start , then the first problem will be shown to him, he has to decide either to solve the problem, to do not solve it and go try the next one, or to stop solving problems. A team member can solve a problem if and only if it's remaining energy is grater or equal to the problem difficulty. Once the team member decides to stop solving problems, he can not solve problems again and the next team member will sit in front of the computer and start with the problem the previous team member left. If the team member i solves problem j, then it will take D_j from his E_i energy and score S_j points to the team. If a team member decides to not solve a problem and go to the next one, no other member in the team can go back to solve it. The contest ends for the team when either there are no more problems to solve, or there are no team members left to work on the remaining problems.

For this particular problem your task is, given the energy of each team member, the difficulty and score of the problems in a contest, determine in what order the team members should solve the problems so the team can score their maximum possible score.

Input

The first line of input contains two integer numbers separated by a space T and P ($1 \leq T \leq 10$, $1 \leq P \leq 100$), representing, respectively, the number of team members in the team, and the number of problems in the contest. The next line contains T integer numbers separated by a space, where the i-th number represents the energy E_i ($1 \leq E_i \leq 100$) of the team member. The next line contains P integer numbers separated by a space, where the i-th number represents the difficulty D_i ($1 \leq D_i \leq 100$) of the i-th problem in the contests, the next and last line of input contains P integer number separated by a space, where the i-th number represents the score S_i ($1 \leq S_i \leq 100$) the i-th problem gives to the team if they solve it.

Output

Output a line with a single integer number, the maximum possible score the team can obtain.

Input example 1	**Output example 1**
3 3 4 2 5 2 2 5 3 2 1	6

Problem B

Beautiful necklaces

Alice just got a new necklace for her birthday. The necklace consists of N beads numbered with IDs from 1 to N, where the bead with ID i and the bead with ID $i+1$ (for each $i \in [1, N-1]$) are connected by a thread and we say that they are neighbors. The bead with ID N and the bead with ID 1 are also connected, and they are neighbors as well. The color of the i-th bead is c_i. Colors are represented by positive integers.

Alice defines the beauty of a necklace as the length of the longest **contiguous** subsequence of beads that have the same color. For example, if Alice's necklace is $N = 8$ and $c = [4, 2, 2, 1, 2, 2, 4, 4]$, then the beauty of that necklace is equal to 3, since the beads with IDs 7, 8 and 1 have color 4, and form the longest contiguous subsequence with the same color.

During the next Q days, Alice will get a new bead. The ID of the new bead gotten in the i-th day will be $N + i$ and its color will be d_i. She can perform one of the two possible actions:

1. Given two IDs a_i and b_i of beads that are currently connected, she cuts a thread that connects them, inserts the new bead between the beads with ID a_i and b_i, and connects each of them to the new bead, so the beads a_i and b_i become the neighbors of the new bead.

2. Given one ID a_i, she removes the bead with ID a_i from its current necklace, connect its previous neighbors with a thread, and creates a new necklace consisting of just two beads: the bead with ID a_i and the new bead. Note that after this operation, Alice will have more than one necklace. It is guaranteed that after this operation, all of the necklaces have length greater or equal to 2.

After the daily operation, Alice wants to know what is the beauty of the necklace where the new bead was inserted, and the beauty of the most beautiful necklace that Alice has at the moment.

Input

The first line contains two integers N and Q ($2 \leq N \leq 10^5$ and $1 \leq Q \leq 10^5$).

The second line contains N integers $c_1, c_2, \ldots, c_N$ ($1 \leq c_i \leq 2 * 10^5$).

The following Q lines contain the description of the operations that Alice will perform. The $(i+2)$-th line begins with two integers t_i and d_i ($t_i \in 1, 2$ and $1 \leq d_i \leq 2 * 10^5$), then some integers follow depending on the operation:

1. If $t_i = 1$, then Alice performs the first operation, and two distinct integers $a_i and b_i$ follow ($1 \leq a_i, b_i < N + i$). It is guaranteed that the beads with ID a_i and b_i are neighbors right before the operation.

2. If $t_i = 2$, then Alice performs the second operation, and one integer a_i follows ($1 \leq a_i < N + i$).

Output

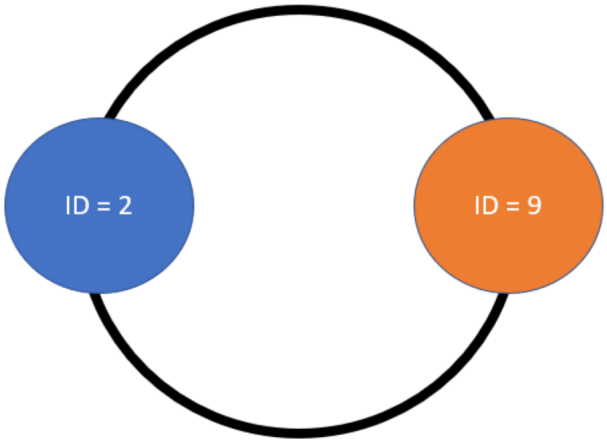
For each operation, print a line with two space-separated integers. The first integer is the beauty of the necklace where the new bead is inserted and the second integer is the beauty of the most beautiful necklace that Alice has at the moment.

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

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

Note

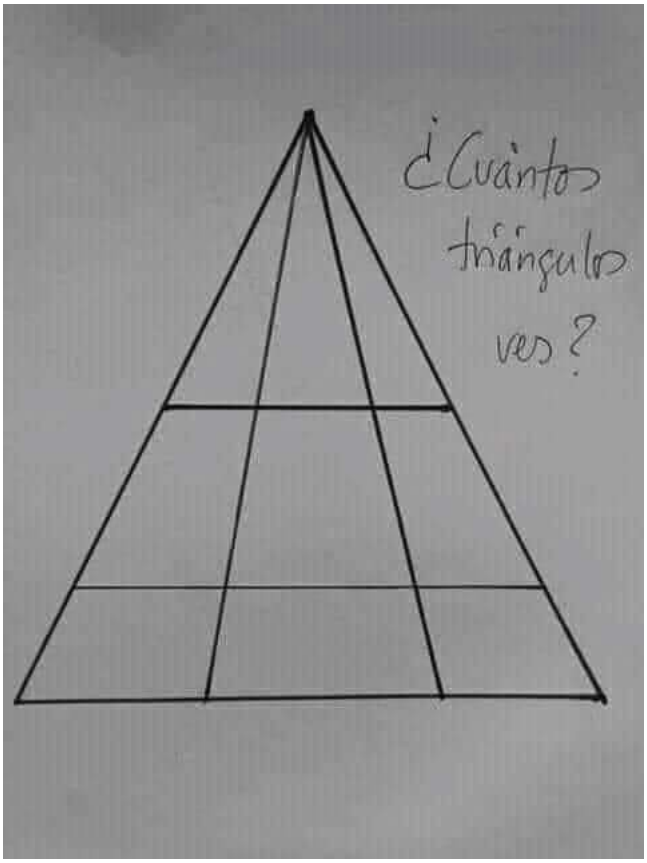
Note that, if a necklace has length equal to 2, the two beads are connected by two threads. For example, if we consider the color 1 as blue and the color 5 as orange, then the necklace formed by the beads with IDs 2 and 9 after the second operation looks like this:



Problem C

Counting triangles

Can you find how many triangles are in the following drawing?



Your task is to count the number of triangles in a drawing similar to the one above, where the outer triangle has N lines inside it going from the top to the base, and K lines inside that are parallel to its base.

Input

The first line contains an integer T $1 \leq T \leq 10^5$, representing the number of test cases. Each of the next T lines represents a test case containing two integers separated by a space, N and K ($0 \leq N \leq 10^9$, $0 \leq K \leq 10^9$), representing, respectively, the number of lines going from the top to the base and the number of lines parallel to the base in the drawing.

Output

For each test case print the number of triangles in the drawing. As this number can be big print it mod 1000000007

Input example 1	**Output example 1**
2 2 2 3 1	18 20

Problem D

Debugging the network

A communication string is defined as a string containing only lowercase letters from the English alphabet ('a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j', 'k', 'l', 'm', 'n', 'o', 'p', 'q', 'r', 's', 't', 'u', 'v', 'w', 'x', 'y', 'z'). In order to make easier and cheaper to send these strings over slow networks a compression method has been defined as follow: If a substring in the string with length of at least 2 characters consists only of occurrences of the same letter, then, replace the substring with its length followed by the letter, this is done always in a way that no two consecutive positions of the string have the same letter. For example, the string *aaaaabbc* would be replaced with the string *5a2bc*. The communication string is compressed before sending the message over the network, then a system receiving the message will decompress the string before the communication is acknowledged to be successful.

After years of this compression method working as expected suddenly some systems in the network started to break, some debugging in the system showed it breaks when the communication string is longer than K characters.

Your task is to determine if the system in the network will not break while uncompressing a compressed string given the compressed string, and the value K.

Input

The first line of input contains a single integer T ($1 \leq T \leq 100$), representing the number of test cases. Each of the next T lines contain a string S ($1 \leq |S| \leq 1000$) and a number K ($1 \leq K \leq 10^6$) separated by a space, representing, respectively, the compressed string and the longest communication string length that is able to be transmitted over the network.

Output

For each test case in the input print a line containing the communication string if the given compressed string is safe to be uncompressed, otherwise print a line with the string "unfeasible".

Input example 1	**Output example 1**
4 5a2bc 8 5a2bc 7 asdf4x 50 asjkdf10000000000kz 1000000	aaaaabbc unfeasible asdfxxxx unfeasible

Problem E

End of the year bonus

The last month of the year is here and everybody loves this month for two reasons: holidays and end of year performance bonus.

It is believed that if an employee performed better than another employee, they must receive a bigger bonus.

Employees do not know each others performance, so they may not know if they are being underpaid. But, as every year, they figured out how to determine if they are being underpaid. N employees will have a meeting sitting in a circular table, and each of them will ask the person sitting next to them (to their right, and their left) what their performance and bonus was. The employee sitting in chair 1 is at the right of employee at chair N, also employee at chair N is at the left of employee at chair 1. And the i-th employee is at the right of the $i-1$-th employee, and to the left of the $i+1$-th employee.

Corporate knows employees do this, so this year they will adjust their bonus giving because they dont want to receive complaints. The will make sure that if an employee performed better than the person sitting next to them, they received a bigger bonus.

Corporate knows the chair where each of the N employees is sitting, help them decide the bonus for each employee in such way that everyone is satisfied (is paid more if performed better than the person sitting next to them) using the less amount of money. The base bonus, for someone with no performance is 0, everyone knows that, and each bonus should be a multiple of B.

Input

The first line of input contains two integer numbers separated by a space N, and B ($1 \leq N \leq 10^5$, $1 \leq B \leq 10^5$), representing, respectively the number of employees, and the number all bonuses should be multiples. The second line contains N numbers separated by a space, where the i-th number represents the performance p_i ($1 \leq p_i \leq 10^6$) for the employee that will sit in the i-th chair in the meeting.

Output

Print a line with N integer numbers separated by a space. Where the i-th number represents the bonus that corporate should give to the employee sitting at chair i in the meeting.

Input example 1	**Output example 1**
8 1 1 2 3 2 1 3 2 1	1 2 3 2 1 3 2 1

Input example 2	**Output example 2**
8 1 0 2 3 2 1 3 2 1	0 1 3 2 1 3 2 1

Problem F

Fit them all

One of the problems in Jaime's package delivery company is to load platforms with the packages that need to be delivered in a day. Each day Jaime needs to ship packages in a platform with a rectangular shape of size W width and H height, these packages are contained in cubic boxes of different sizes, but, as Jaime loves sequences, he always loads the platforms starting with a box with size 1x1x1, then with a box with size 2x2x2, and the K-th loaded box in the truck will be of size KxKxK. Since all the packages contain fragile material, the boxes can not be stacked, this is, a box can not be over another box, but they can be placed side by side without leaving any empty space between them.

Jaime needs your help to find the maximum number of packages that can be loaded in a given platform.

Input

The first and only line of input contains two integer numbers separated by a space, W and H ($1 \leq W, H \leq 30$), representing the width and height of the rectangular shaped platform.

Output

Output a line containing a single integer, the maximum number of boxes that can be loaded into the platform.

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

Input example 2	**Output example 2**
4 3	2

Problem G
Gold Fever

A gold rush or gold fever is a new discovery of gold that brings an onrush of miners seeking for fortune. Major gold rushes took place in the 19th century in Australia, New Zealand, Brazil, Canada, South Africa and the United States, while smaller gold rushes took place elsewhere.

In the 19th century the wealth that resulted was distributed widely because of reduced migration costs and low barriers to entry. While gold mining itself proved unprofitable for most diggers and mine-owners, some people made large fortunes while merchants and transportation facilities made large profits. The resulting increase in the world's gold supply stimulated global trade and investment. Historians have written extensively about the mass migration, trade, colonization and environmental history associated with gold rushes.

A rush typically begins with the discovery of placer gold made by an individual. At first the gold may be washed from the sand and gravel by individual miners with little training, using a gold pan or similar simple instrument. Winning the gold in this manner requires almost no capital investment, only a simple pan or equipment that may be built on the spot, and only simple organisation.

Bob has found an interesting book explaining some weird methods used by miners to maximize the gold they obtained from a river during the 19th century gold fever, the book explains some miners would divide the river in N sections numbered from 1 to N, and start panning for gold on any of the river sections, after panning the gold g_i in a given section i of the river, the miner will continue panning the gold in another section with a number between $i + a_i$ and $i + b_i$. Miners using this method would never walk backwards to not be suspicious of them looking for more gold, the fewer looking for gold in a river the more gold a miner would be able to win. Some time later, Bob found in the same book records of the rivers explored by some miners, each of these records have the amount of gold the river had on each section and the values $[a_i, b_i]$ that would be used to determine the next section to go on after getting the gold in each section.

As bob knows your programming skills, he wants some help to find what would be the maximum amount of gold a single miner would be able to get following the method described in his book, if he knew beforehand all the information in the records Bob found.

Input

The first line of input contains a single integer N ($1 \leq N \leq 10^5$), representing the number of sections the river is divided into. Each of the following N lines contain three integers separated by a space, g_i, a_i, b_i ($0 \leq g_i \leq 100$, $1 \leq a_i \leq b_i \leq N$), representing respectively, the amount of gold in section i, and the range $[a_i, b_i]$ used by the miners to determine the next section to go for gold.

Output

Output a line containing one integer. The maximum amount of gold a single miner would be able to get following the method described in Bob's book

Input example 1	**Output example 1**
5 1 1 1 1 1 1 3 1 2 5 2 3 10 1 1	15

Input example 2	**Output example 2**
8 7 3 5 2 3 5 1 3 5 3 3 5 9 3 5 2 3 5 1 3 5 3 3 5	19

Problem H

How to Work Less to Pass a Programming Course in Planet E-13

Planet E-13 orbits around a star in a far away galaxy named UAZ. All University students in that planet need to pass a Programming online course. For the course, the teacher assigns a set of programming problems numbered 1 to N to solve during the term. The teacher of such course is known for changing the number of problems and the number of points assigned to each problem every term, and the sum of points for all problems is not necessary the same every term, but he never assigns more than 20 problems to solve in a term and never assign more than 1000 points to each problem. The teacher uses a 0 to 100 scale for the final grade of the course and each program submitted is accepted only if it passes all the tests, for instance, if the teacher assigns 180 points to problem number 10, creates 15 tests, and a student submits a solution for such problem that passes all 15 tests, then the student receives 180 points, but if the solution passes only 5 of the 15 tests, then the student receives no points at all for such program. Also, the number of points for each problem and the final grade are always integers, truncating the grade if necessary, so for instance, if the teacher assigns 5 problems with the following points: $320, 170, 235, 23$ and 78 (resulting in 826 total points) and the solutions accepted for a given student are for problems $1, 2$ and 5, the student would get $320 + 170 + 78 = 568$ points resulting in a grade of $568/826 * 100 = 68.76 = 68$.

Thanitos is a student that will be taking the Programming Course this term and he wants to solve the minimum possible number of problems in such a way that he achieves at least a certain grade G, knowing that he prefers to solve the problems with lower numbers. Given a set of problems to solve, Thanitos assigns a number to the set in the following way: he starts with the number 0, if the set contains problem 1 then he sums 2^0, if the set of problems to solve contains problem 2, then he sums 2^1, more generally, if the set contains the problem i, then he sums 2^{i-1}. Two sets of problems are the same if the number assigned by Thanitos to both sets is the same. Given the number of problems the teacher will assign during the term, the minimum grade Thanitos wants to achieve and the points assigned to each problem, help Thanitos find all the different sets of problems to get at least the grade G solving the minimum possible number of problems, also tell him what grade he would achieve by solving each set.

Input

The first line contains two numbers separated by a space : N, and G. Representing the number of problems assigned in the term and the minimum grade Thanitos wants to achieve in the the term. The second line will contain N integer numbers P_i representing the number of points assigned to each of the N problems.

- $1 \leq N \leq 20$
- $1 \leq G \leq 100$
- $1 \leq P_i \leq 1000$

Output

The output consists of $C + 1$ lines. The first line of the output contains two integer numbers separated by a space: M, C, where M represents the minimum number of problems Thanitos needs to solve to achieve at least the desired grade G, and C represents the number of combinations that would allow him to achieve at least the desired grade.

Each of the following C lines represents a combination of the minimum number of solved problems that would allow Thanitos to get at least the desired grade. Each of these C lines include $M + 1$

integers separated by a space, where the first integer R represents the grade Thanitos would achieve using this combination and the remaining M numbers S_i represent the problem numbers that Thanitos needs to solve to get the grade R, where $S_1 < S_2 < \ldots < S_M$. These C lines are ordered in such a way that the numbers that Thanitos would assign to each set go from the lowest possible to the highest possible. Remember that Thanitos prefers working with lower number problems so we will provide him the options ordered according to his preferences.

Input example 1	**Output example 1**

`5 75`
`320 170 235 23 78`
	`3 2`
	`87 1 2 3`
	`76 1 3 5`

Input example 2	**Output example 2**

`4 70`
`100 230 150 150`
	`3 3`
	`76 1 2 3`
	`76 1 2 4`
	`84 2 3 4`

Problem I

Is this the best deal?

This weekend a famous online book store has a great sale. "Order at least $500 and get $100 off", this is, if you buy $\$X$ where $X \geq 500$ then you pay $X - 100$, for example if you order a total of $500 you only pay $400, if you buy $600, you pay $500, but if your order is $\$X$ where $X < 500$ then, you pay $\$X$. Each of your team members wants to buy a different book from this store and after this discount was announced you three decided to see if you can pay less combining the purchases, this is, you want to see if you can pay less by purchasing the books in a single order, with two orders, or not combining at all (which would lead to place three different orders).

Given the prices of the books each of you want to buy, find the minimum amount you need to pay for the three books with the discount announced by the store.

Input

The first and only line of the input contains three integer numbers separated by a space, representing the prices of the book each team member wants to buy. The price of each book will be between 1 and 1000.

Output

Output a single line with an integer number, the minimum amount to pay in order to buy the three books.

Input example 1	**Output example 1**
`50 310 150`	`410`

Input example 2	**Output example 2**
`5 10 15`	`30`

Input example 3	**Output example 3**
`490 10 500`	`800`

Problem J

Jaime's greedy delivery

It is year 2040 and teleportation is now a real thing, at least, between certain pairs of cities. This has been a huge improvement for Jaime's package delivery company, since now it is possible to travel between certain cities in a fixed amount of time K, instead of the usual variable time between cities because of the heavy traffic or the long distances. There are a total of N cities in Jaime's world, and M pairs of cities where Jaime can use teleportation to move between them. If teleportation can be used between the cities a and b, then teleportation can be used also to move between cities b and a.

This new technology also encouraged Jaime's greed. Instead of having employees to carry packages, he fired all of them and he is the only one working for the company. For Jaime, the less employees the company has, the more profit, hence, the maximum profit achievable is when there is only one employee, himself.

Jaime was hired by a well known e-commerce site to deliver a delivery order of packages for them. A delivery order consists of O packages, each package has to be delivered to city o_i, and they should be delivered in the order given by the e-commerce site. This is, if the delivery order is $O = [1, 2, 5]$, then Jaime should deliver the first package to city 1, the second package to city 2 and the third package to city 5, and he should deliver them in this specific order. Jaime will pick the O packages to deliver and the order in which these should be delivered always in city 1. Since the e-commerce site claims they always deliver the packages faster than all their competitors they need Jaime to deliver all the packages and return to the warehouse in a time no greater than T.

Jaime is well known in all the cities as he has been working delivering packages in all them for more than 20 years, and on every delivered package there is always someone waiting for Jaime to request an special delivery, the special delivery is simple, they just need a package to be delivered to the city d_i and they will pay Jaime v_i if Jaime takes the job. As Jaime's greed makes him want always more money, he may decide to take the special delivery getting him out of his original schedule. If Jaime decides to take a special delivery he will deliver that package immediately and then he will continue with his original delivery order (for which he was hired by the e-commerce site).

Given the order list given by the E-Commerce site to Jaime, and the list of special requests he will get on each delivered package, help him finding the maximum amount of extra money he can get complying with the e-commerce site time restrictions.

Input

The first line contains three integer numbers separated by a space N, M, and K ($1 \leq N \leq 1000$, $1 \leq M \leq 10000$, $1 \leq K \leq 10$). representing, respectively the number of cities, the number of pairs of cities that can be used for teleportation, and the fixed amount of time it takes to teleport between cities. The next M lines contain two integer numbers separated by a space a_i and b_i ($1 \leq a_i, b_i \leq N$), representing that Jaime can be teleported between cities a_i and b_i. The next line contains two integer numbers O and T ($1 \leq O \leq 1000$, $1 \leq T \leq 10^4$), representing the number of packages Jaime has to deliver and the maximum time he has to deliver all packages and return to the warehouse. The next line contains O integer numbers separated by a space, where the i-th number in the line represents o_i ($1 \leq o_i \leq N$), the city where the i-th package should be delivered. Each of the following O lines in the input contains two integer numbers separated by a space, representing the city d_i ($1 \leq d_i \leq N$) where the package of the special request in the i-th delivered package should be delivered and the value v_i ($1 \leq v_i \leq 100$) Jaime will get if he accepts the special delivery.

Output

Output a line with a single integer number, the maximum amount of extra money Jaime can get from the special deliveries complying with the e-commerce site restrictions. In case Jaime can not comply with the time restrictions given, print a single line with the string *Impossible*

Input example 1	**Output example 1**
5 4 1 1 2 2 3 3 4 4 5 2 8 5 2 2 10 5 20	10

Problem K

K contestants

Elisa's high school is preparing to compete on the 2020 regional algorithms competition. The high school should register exactly K contestants to the competition, as they believe the students on the last grade are the most capable to win the competition, they will register the K contestants only from the last grade. The high school has 3 groups in the last grade, the A, B, and C. Teachers from the C group say students in this group have better grades in mathematics than those in groups A and B, and, therefore, they say there should be exactly c students from group C in the K registered contestants. To make sure all the groups have representation in the competition, the school principal decided that at least one student from each group should be registered.

Given the number of students in groups A, B, and C, the number of contestants K that should be registered by the school in the competition, and the number of c students from group C that should be registered in the competition. Find the number of different ways the school can choose the K students to register in the competition.

Input

The first line of input contains a single integer T, the number of test cases. Each of the next T ($1 \leq T \leq 10^5$) lines, describe a test case, containing a single line with 5 integer numbers separated by a space, representing, respectively, the number of students in group A, the number of students in group B, the number of students in group C, the number of students K to be registered in the competition, and the number of students c from group C that should be registered in the competition. It is guaranteed that: $1 \leq A, B, C, K \leq 10^5$, $1 \leq c \leq C$

Output

For each test case in the input, print a single line with an integer representing the number of different ways the school can choose the K students to register in the competition. As this number can be big, print it modulo 1000000007

Input example 1	**Output example 1**
2 3 3 3 7 2 3 3 3 10 2	18 0

Problem L

Let's count words

Two words W_1 and W_2 are said to be generated from the same word W, if the three words have the same length L, and you can read both W_1 and W_2 from W reading exactly L letters starting at a position in W. If while reading from W you get to the end of the word you start again from the first position. For example *rdwo* and *ordw* are both generated from the same word *word*, the first one is if you start reading from the third position of the word, the second one is if you start from the second position. A word W is generated from the same word W as you can read the word starting at the first position of it.

Given a list of N words, can you find how many different generator words W were used to create the list?

Input

The first line of input contains a single integer N ($1 \leq N \leq 100$), representing the number of words in the list. The second and last line of input contains N strings separated by a space, representing the N words in the list. Each word in the list will contain only lower case letters from the english alphabet and will have no more than 100 letters

Output

Print a single line with an integer, representing the number of different generator words W that were used to create the list.

Input example 1	**Output example 1**
7 word icpc rdwo dwor ordw pcic ccpi	3

Problem M

Mathematics society problem

Nlogonia secret mathematics society helds meetings with distinguished members that are able to solve a given mathematical problem. Being one of the most prestigious mathematics societies in the region you want to participate in the meeting, they discuss in this meetings a lot of interesting problems and their solutions, and therefore, it could be also a very good place to train your algorithmic skills.

The problem to be invited to the next meeting has been posted, last month meeting they used an interesting problem that generated long lists of numbers. This time, they want you to work with some of these numbers. They will give you a number N that contains only digits from 1 to 9, your task is to remove a specified amount of each digit from N and get the biggest possible number. Will you be able to join this month meeting?

Input

The first line of input contains a number N, N will have at most 1000 digits. The second and last line of input contains 9 integer numbers separated by a space, where the i-th number represents the amount of times the digit i should be removed from N. It is guaranteed that no digit should be removed more times than it appears in N, and that in no case all digits from N should be removed.

Output

Output a line containing a number, representing the biggest number you can get after removing the specified digits from N.

Input example 1	**Output example 1**
12345 1 0 0 1 1 0 0 0 0	23

Input example 2	**Output example 2**
112345 2 1 1 0 0 0 0 0 0	45

Input example 3	**Output example 3**
54321 0 0 0 0 0 0 0 0 0	54321

Problem N

Network connection

A new road connecting Nlogonia and Quadradonia was built, the road is a straight line of D meters long. Nlogonia is at meter 0 in the road, and Quadradonia is at meter D in the road. One of the advantages of this road is it offers free internet access to anyone that travels it using public transportation system, this encourages people to travel between the cities without using their vehicles reducing in this way carbon emissions between the cities.

To provide internet access in all the road M internet antennas have been installed along the road. Two antennas in the road can pass internet signal between them if and only if the distance between them is less or equal than a configured frequency range. In the same way an antenna is connected to a city internet network if the distance from the antenna to the city is less or equal to the antenna range. The frequency range of the antennas can be configured to any positive integer, but, in order for the antennas to work properly, this value should be the same for all the antennas in the road.

People that travels using public transportation in the road have filled several complains stating they do not have internet access in all the road, so, the public transportation officers of the cities have asked you to investigate further and fix the problem.

You need to review the current installation of the internet antennas, your task is to find the minimum range that should be configured to the antennas to make sure that there is a connection between Nlogonia and Quadradonia. For such connection to exists, there should be a set of antennas in such way that at least one antenna is connected to Nlogonia internet network, at least one antenna is connected to Quadradonia internet network, and for every other antenna there is a way to pass internet signal to both cities, following a set of antennas with the configured frequency range. To help you in this mission the public transportation officers will assign a budget B, and they will allow you to move the antennas from their current position, but you can not install more antennas, moving an antenna m meters from it's initial position will cost you m from the given budget.

Given the current position of the M antennas, the budget B assigned, and the distance D of the road, write a program that finds the minimum range frequency that can be configured to the antennas to connect internet in all the road without exceeding the budget B.

Input

The first line of input contains three integers separated by a space, D, B, and M ($1 \leq D \leq 5000$, $0 \leq B \leq 10^6$, $1 \leq M \leq 100$), representing respectively, the distance of the road, the maximum budget you can spend, and the number of installed antennas in the road.The second and last line of input contains M integer numbers separated by a space, the values p_i ($0 \leq p_i \leq D$), representing the i-th antenna is positioned at meter p_i in the road.

Output

Output a line containing a single integer, the minimum range frequency that can be configured to the antennas to connect internet in all the road without exceeding the budget.

Input example 1	**Output example 1**
10 0 2 0 10	10

Input example 2	**Output example 2**
10 5 2 0 10	5

Input example 3	**Output example 3**
10 5 2 0 0	5