ACPC
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Collegiate Programming
Championship

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ECPC
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16-08

(Contest Problems)

AAST, Egypt
August 2022

Problem A. A Story

Input file:	`story.in`
Output file:	`standard output`
Balloon Color:	`Orange`

Once upon a time in a world that looks like ours a story of a person who looks like many of us is about to begin and it unravels like a jigsaw puzzle. Make sure to open your eyes and focus, as things can look like a duplicated version of another person's story but soon you will know that it is exceptionally different than any other story you've experienced.

For it being a great harmonic and very imminent journey where paths may cross. Kudos to those who hone their knowledge and leverage their skills as marching into the future would definitely require them.

Our story starts with Ahmed, an ambitious bus driver. In his journey driving the bus, he passes through N stations located at positions $S_1, S_2, ..., S_N$ along the positive X-axis. In order to ride the bus at the i-th station, a passenger must pay C_i dollars. You are also given an array D with length $N-1$ such that D_1 represents the distance between station 1 and station 2 in meters, D_2 represents the distance between station 2 and station 3 in meters, and so on.

Ahmed starts his journey at the 1-st station at time 0. Your task is to calculate the maximum number of dollars Ahmed can earn throughout his entire journey.

Each station i has two properties:

- P_i denoting the number of passengers that come to the station per second.
- G_i denoting the maximum time a passenger can wait for the bus, but when the passenger enters the bus, he will never leave the bus.

You should note the following:

- The bus travels at the speed of one meter per second.
- Ahmed can only stop in the stations (he never stops between them).
- When the bus stops at a specific station, it will take exactly 2 seconds to go again and continue its journey.
- The bus has **infinite capacity (meaning that it can accommodate any number of passengers at the same time).**

Input

The first line of the input file contains a single integer T ($1 \leq T \leq 100$), the number of test cases. Description of the test cases follows.

The first line of each test case contains a single integer N ($1 \leq N \leq 10^4$) — the number of stations.

The second line contains N space-separated integers $C_1, C_2, ..., C_N$ ($1 \leq C_i \leq 10^3$) — The cost of riding the bus at station i.

The third line contains $N-1$ space-separated integers $D_1, D_2, ..., D_{N-1}$ ($1 \leq d_i \leq 10^3$) — The distance between each two consectuve stations.

Then fourth line contains N space-separated integers $P_1, P_2, ..., P_N$ ($1 \leq P_i \leq 10^3$) — Number of passengers per second.

The fifth line contains N space-separated integers $G_1, G_2, ..., G_N$ ($1 \leq G_i \leq 10^3$) — The maximum time a passenger can wait for the bus.

Output

For each test case, print the maximum profit Ahmed can make in dollars.

Example

story.in	standard output
1 5 10 12 5 3 2 4 3 2 5 2 4 5 2 3 5 2 1 10 11	457

Problem B. Begins and it

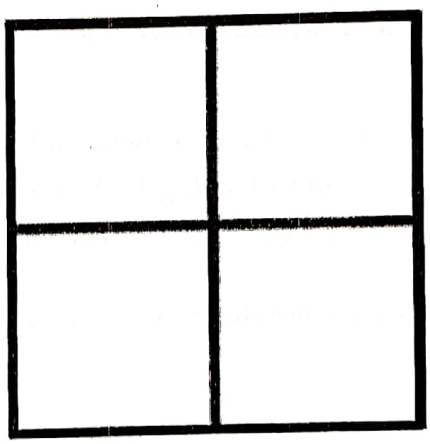
Input file:	`begin.in`
Output file:	`standard output`
Balloon Color:	`White`

Just like any story, it begins with an ambitious person, Maha. And as it moves forward, paths start to appear and connect. And as it takes two to Tango, Endure Capital, the ACPC Community Partner, believing in the relentless execution to build and achieve hyper-growth, starts investing in Maha's future journey.

But not all journeys consist of only straight lines. Maha is given a figure that has N parallel horizontal lines and M parallel vertical lines such that all horizontal lines intersect with all vertical lines. Note that all lines are unique (there aren't any lines that have the same slope and y-intercept).

Maha is tasked is to count how many different rectangles appear in the figure. A rectangle is produced when two horizontal lines intersect with two vertical lines. Two rectangles are considered different if one of the rectangles has at least one line (either horizontal or vertical) that does not exist in the other rectangle.

For example: If $N = 3$, $M = 3$, then the answer is 9.



Since the total number of different rectangles can be very large, Maha will have to print its remainder modulo $10^9 + 7$. Maha is able to solve the question, and asks you if you can do the same?

Input

The first line of the input is the number of test cases T.

Each test case contains contains two integers N and M $(2 \leq N, M \leq 10^9)$ — The number of horizontal lines and vertical lines, respectively.

Output

For each test case output print a single integer, the number of different rectangles that appear in the figure taken modulo $10^9 + 7$.

Example

begin.in	standard output
2 3 3 4 5	9 60

Problem C. Can look like a

Input file:	looklike.in
Output file:	standard output
Balloon Color:	Yellow

A deja vu is a French word expressing the feeling that one has lived through the present situation before. It seems that this story of the passionate Youssif can look like a story written by a different self in a different universe, yet something seems to be a bit different.

Youssif is a video game player who is interested in getting a Penta in his current game. Youssif can get Penta if he can send messages to 5 players but it's not that simple.

When Youssif send a message to a team player, the message disappears after a relatively short time. Youssif will get a Penta if there is a point in time where the 5 players recieve messages without any of them disappearing.

Given the seconds at which Youssif sent messages through the whole game and the disappearance time of each message, can you determine if Youssif got a Penta or not?

If Youssif send a message to the fifth player at a second and another player's message disappears at the same time, it isn't considered a Penta.

Note that if Youssif sends a message to a player. He can't send any other messages to that same player until the current message disappears.

Also, note that the team consists of exactly 5 players (other than Youssif).

Input

The first line of input contains the number of test cases T ($1 \leq T \leq 100$).

The first line of each test case contains an integer N ($1 \leq N \leq 10^4$) the number of messages Youssif sent.

The second line contains N integers $A_1, A_2, ..., A_N$ ($1 \leq A_i \leq 10^4$) which represents the time spots at which youssif sent messages.

The third line contains N integers $B_1, B_2, ..., B_N$ ($1 \leq B_i \leq 50$) which represents the number of seconds needed for the i-th message to disappear.

Output

For each test case, output PENTA if youssif could get a penta, and print NO PENTA if he could not get a penta. The output is case senstive

Example

looklike.in	standard output
2 5 1 3 4 9 10 20 15 10 2 5 5 1 3 4 9 10 20 15 6 2 5	PENTA NO PENTA

Note

In the first case, Youssif got a Penta as follows:

- He sent a message the first player at second 1 and the message will disappear after 20 seconds (at second 21).

- He sent a message to the second player at second 3 and the message will disappear after 15 seconds (at second 18).
- He sent a message to the third player at second 4 and the message will disappear after 10 seconds (at second 14).
- He sent a message to the fourth player at second 9 and the message will disappear after 2 seconds (at second 11).
- He sent a message to the fifth player at second 10 and the message will disappear after 5 seconds (at second 15).

At second 10, all five players have a message from Youssif.

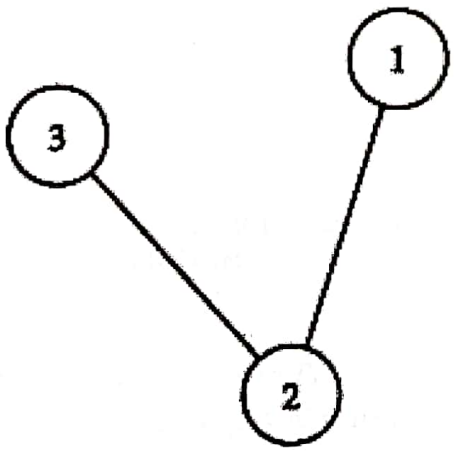
In the second case, we find that the third player's message disappeared at second 10 so when Youssif sent a message to the fifth player he will find that the third message disappeared so it isn't considered a Penta.

Problem D. Duplicated version but

Input file:	`duplicated.in`
Output file:	`standard output`
Balloon Color:	`Silver`

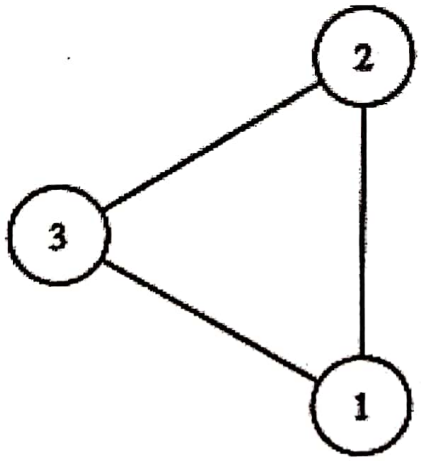
A deja vu is a French loanword expressing when one feels they have lived through the same situation in the past. It almost looked like a duplicated version and they certainly got us in the first part, but even when things look exactly similar, the tiniest butterfly movement can make the whole difference.

A group of scientists invented a new thing which is a cyclic permutation and we are investigating it. But what is a cyclic permutation? First we will see how we construct a graph from the premutation. Suppose we have a permutation of size N. You make an edge between every number and the first number bigger than it and after it and the first number bigger than it and before it and these edges are undirected. After constructing the graph if it is a cycle of size n this is counted as cyclic permutation. For example take the permutation 1 2 3. for the 1 the first number after it and bigger than it is 2 so there is an undirected edge between 1 and 2 but there is no number before it. For 2 the first number after it and bigger than it is 3 so there is an undirected edge between 2 and 3 but there is no number before it and bigger than it. For 3 there is neither number after it and bigger than it nor number before it and bigger than it. The final graph is shown below and it is not a cycle of size 3 so this is not a cyclic permutation.



Let's have another example let's take the permutation 2 1 3. for the 2 the first number after it and bigger than it is 3 so there is an undirected edge between 2 and 3 but there is no number before it. For 1 the

first number after it and bigger than it is 3 so there is an undirected edge between 1 and 3 and the first number before it and bigger than it is 2 so there is an undirected edge between 1 and 2. For 3 there is neither number after it and bigger than it nor number before it and bigger than it. The final graph is shown below and it a cycle of size 3 so this is a cyclic permutation.



You are given a number N we want you to output how many cyclic permutations of size n. The number can be very large so output the number MOD 1e9+7.

Input

The first line of the input is the number of test cases T.

Each test case contains one line with integer N ($1 \leq N \leq 10^5$) — the size of the permutation.

Output

For each test case output the number of cyclic permutations each in a separate line.

Example

duplicated.in	standard output
3 2 3 4	0 2 4

Note

The answer for 3 is 2 because the permutations 2 1 3 and 3 1 2 are cyclic permutations. The first one is drawn in the statement.

Problem E. Exceptionally different

Input file:	`different.in`
Output file:	`standard output`
Balloon Color:	Red

Reading through others' lives, Hossam discovers that everything looks so familiar, yet everything is so exceptionally different. Hossam decides that for it being a great harmonic imminent journey, it is worth a little bit of a spoiler alert. But eventually, kudos to those who figure the story out. And as always Coach Academy, the ACPC Training Partner, jumps into the picture with training opportunities to provide guidance and lend a hand to Hossam through his big journey ahead.

Recently, Hossam bought a new beautiful garden. The garden has N kinds of plants in it. Each plant has a maximum height of H_i which indicates that it has become fully grown. Each plant also has a current height C_i.

Each day, all plants grow one centimeter. If it wasn't fully grown, you can use fertilizer to make the plant grow one more centimeter. You can't use the fertilizer more than once per day per plant. If the plant's current height is 0, it would not start to grow until you use the fertilizer on it.

You have a budget of X dollars, and each time you use the fertilizer, you pay exactly K dollars.

Your task is to output the minimum number of days needed to make all plants fully grown without exceeding the budget.

Input

The first line contains a single integer T ($1 \leq T \leq 1000$) — the number of test cases.

The first line of each test case contains three integers N, K, and X ($1 \leq N \leq 1000, 0 \leq K \leq X \leq 10^9$), the number of plants, the cost of using the fertilizer once, and your budget, respectively.

The second line of each test case contains N integers $H_1, H_2, H_3, ..., H_N$ ($1 \leq H_i \leq 10^9$), where H_i denotes the maximum height of the i-th plant.

The third line of each test case contains N integers $C_1, C_2, C_3, ..., C_N$ ($0 \leq C_i \leq C_i$) where C_i denotes the current height of the i-th plant.

Output

For each test case output the minimum number of days needed to make all plants fully grown without exceeding the budget. If it's impossible to do so, print -1.

Examples

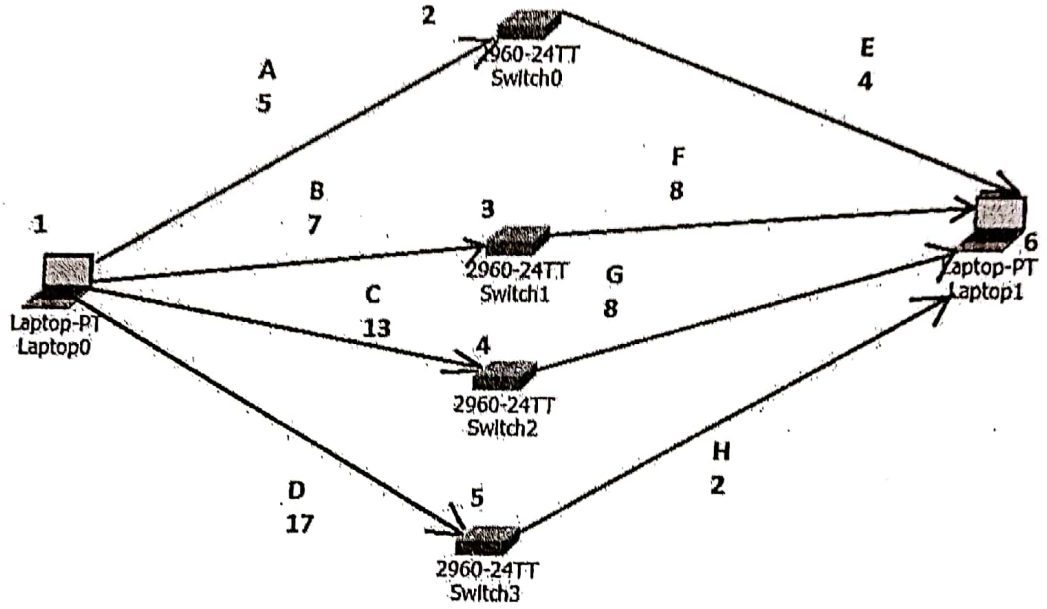
different.in	standard output
3 6 2 10 6 5 9 2 8 10 0 0 0 0 0 10 6 2 20 6 5 9 2 8 10 0 0 0 0 0 10 6 10 20 5 6 3 2 9 10 0 3 0 2 3 0	9 8 -1
5 9 9 10 28 52 73 81 63 85 100 1 72 17 42 53 25 58 38 76 1 20 8 5 9 16 58 45 42 32 65 32 85 8 11 20 42 17 38 22 27 7 9 10 88 100 67 68 61 78 80 60 12 43 6 36 10 68 9 1 1 49 86 7 15 40 2 71 52 87 11 72 4 5 7 2 20 9 22 7 9 10 11 85 86 20 60 84 78 7 79 27 4 43 48 2	55 57 87 64 75

Problem F. For it being a

Input file:	being.in
Output file:	standard output
Balloon Color:	Blue

It is the year 1608, and people are so excited about the newest inventions. Who could imagine that the stars are just so beautiful seen up close. It is the new era for telescopes. For it being so full of potentials, Samar can't wait to pursue her goals and study even more, as now, a new knowledge realm has just been opened.

Samar is a network geek! She wants to connect two computers with each others but there are a lot of possibilities.



Samar has a directed graph. Her computer is the node 1 and the other computer is the node N. Unfortunately Samar's computer can transfer data to the other computer only if the total distance between them is less than or equal to X. Let's call the edges that are not in the path between the two computers unnecessary edges. Given the graph which Samar has, you want to print the unnecessary edges' names in an ascending order.

Input

The first line of the input is the number of test cases T.

Each test case starts with a line contains three integer N ($1 \leq N \leq 10^3$), the number of nodes. M ($1 \leq M \leq 10^3$), the number of edges, X ($1 \leq X \leq 10^4$), the maximum distance.

Then M lines follow. Each line represent an edge in the graph and contains three integers U_i, V_i and C_i and a string S_i. This means an edge with a length C_i ($0 \leq c \leq 100$) and a name S_i ($1 \leq |S| \leq 20$) between nodes U_i and V_i, where ($1 \leq U_i, V_i \leq N, U_i \neq V_i$). It is guaranteed that the names are unique.

Output

For each test case output the unnecessary edges' names in an ascending order each in a separate line.

Example

being.in	standard output
1 6 8 18 1 2 5 A 1 3 7 B 1 4 13 C 1 5 17 D 2 6 4 E 3 6 8 F 4 6 8 G 5 6 2 H	C D G H

Problem G. Great

Input file:	great.in
Output file:	standard output
Balloon Color:	Rose

What an eventful year, it's 1609, a year since Samer started his plan. A pursuit of one's goal has never been so fulfilling. As the impact is so rewarding. The great plan continues with the great support of the Arab Academy for Science and Technology (AAST), the ACPC Headquarter. It is for sure, a base reason for establishing Samer's future plans.

Samer decides to study Geometry. He recently knew that not every triplet of positive integers can form a triangle such as 1, 3 and 7 can't form a triangle but 3, 4 and 5 can form one. Now Samer is given three positive integers X, Y, Z and He wants to find any triplet of numbers A, B, C that are side lengths of triangle such that the following condition holds:

$$\frac{A+B+C}{2} = X + Y + Z$$

Can you help Samer solve this task?

Input

You are given T test case where $(1 \leq T \leq 10^5)$

The first line of each test case contains three positive integers X, Y, Z where $(1 \leq X, Y, Z \leq 10^9)$

Output

Print T lines each line contains the answer for each given test case.

It can be proved that the answer always exist if there are multiple answers print any of them.

Example

great.in	standard output
3 1 4 7 6 8 10 5 5 5	11 10 3 20 10 18 10 11 9

Problem H. Harmonic

Input file:	`harmonic.in`
Output file:	`standard output`
Balloon Color:	`Black`

A journey is never the end. It is always only a checkpoint that was completed if you really think about it. As one path comes to an end, it suddenly forks into many. Bella was just there, her choice of the next move was everything harmonic for our story.

Bella has a game consisting of a board and a very interesting and unique drop of water. Initially the drop of water existed in one cell. In one move, the drop of water results in four more copies of itself in the adjacent up, down, left and right cells.

Each copy behave like the actual drop of water i.e., each copy result in four more copies in one move.

If the initial cell is (x,y), then the four copies of the water drop will be in the cells:

$(x+1, y)$

$(x, y+1)$

$(x-1, y)$

$(x, y-1)$

Knowing the number of moves, Bella wants your help to determine the cells that have the water drop or any of its copies.

Input

The first line of input contains the number of test cases T ($1 \leq T \leq 100$).

The first line of each test case contains one integer N ($1 \leq N \leq 10^5$) the number of moves.

Output

For each test case, output a single integer, the number of cells that have a water drop or a copy of it.

Example

harmonic.in	standard output
3 1 2 3	5 13 25

Problem I. Imminent

Input file:	`imminent.in`
Output file:	`standard output`
Balloon Color:	`Green`

With the upcoming plans, Bola knows that crossing paths again with others' stories is imminent. He knows that even if things appear to take the same turns, it is always different when you look up close and invest in seeing. Bola is very considerate to this when they plan their next move.

Bola likes to invent things, but often he takes some time to build his inventions. Bola is participating in a scientific competition. Bola's newest inventions needs X days to be built, but the competitions is in Y days. We need to know if Bola's invention will be ready for the competition or not.

The invention will be ready for the competition if it is built the day of the competition or any day before that.

Input

The first line of the input is the number of test cases T.

Each test case contains one line with two space-separated integers X and Y ($1 \leq X, Y \leq 10^9$), denoting the number of days Bola's invetntion needs to be built and the number of days before the compeitions, respectively.

Output

For each test case print a single line containing YES if Bola's invention will be ready for the competition. Otherwise, print NO.

Example

imminent.in	standard output
3 2 5 10 3 4 4	YES NO YES

Problem J. Journey

Input file:	`journey.in`
Output file:	`standard output`
Balloon Color:	`Purple`

Have you noticed yet? It's never been about the end of the journey. There is always what is coming next. It is about what happens throughout the journey with all the paths and turns. It is like an Arena, or to be more specific, a Talents Arena, the place where geeks just like Amira find what they have always been looking for!

Amira is always looking for binary numbers. Whenever she finishes her exams, she plays with binary numbers as she loves them so much. She has two huge binary numbers a and b. Both of which have a length (number of digits) of N.

Amira starts with a summation of 0 and does the following operation as long as $b \neq 0$:

- Add to the current summation the value of $a|b$.
- Divide b by 2.

Your task is to calculate the summation at the end of Amira's operations in the decimal notation modulo 998244353.

The value $a|b$ means the bitwise OR of a and b.

For example if $a = 1010_2$ and $b = 1000_2$ then the value $a|b$ will be equal to 10_{10}, not to 1010_2.

Input

The first line of the input file contains a single integer T, the number of test cases.

Each test case contains three lines.

The first line contains a single integer N the length of a and b ($1 \leq N \leq 10^4$).

The second line contains a, a huge binary number that consists of exactly n digits (zeroes and ones), and the first digit is always 1.

The third line contains b, a huge binary number that consists of exactly n digits (zeroes and ones), and the first digit is always 1.

Output

For each test case, print a single line containing the summation in decimal notation modulo 998244353.

Example

journey.in	standard output
1 4 1010 1101	51

Note

For the first example:

- Add to the answer $1010_2|1101_2 = 1111_2 = 15_10$ and set $b := 0110$
- Add to the answer $1010_2|0110_2 = 1110_2 = 14_10$ and set $b := 0011$

- Add to the answer $1010_2|0011_2 = 1011_2 = 11_10$ and set $b := 0001$
- Add to the answer $1010_2|0001_2 = 1011_2 = 11_10$ and set $b := 0000$

So the summation is $15 + 14 + 11 + 11 = 51$.