ACM-ICPC 2015-2016

Ho Chi Minh City University of Science Training Camp

Team Selection Final Round

HCMUS, October 11, 2015

Contest length: 5 hours

The problem set consists of 10 problems in 13 pages (excluding the cover page):

- Problem A: Freshmen Banquet
- Problem B: Skiing Map
- Problem C: Cups and Balls
- Problem D: Save My Brother
- Problem E: Wizard-of-Ozs Spells
- Problem F: Baymax Insider Expo
- Problem G: Anywhere Door 2.0
- Problem H: WICKED Is Good?
- Problem I: Coming Home
- Problem J: When a Fighter Has to Think

Problem A. Freshmen Banquet

Input file:	`stdin`
Output file:	`stdout`
Time limit:	1 second
Memory limit:	512 megabytes

Today is the back-to-school day of Minions! Traditionally, Dr. Nefario will open a banquet to welcome freshmen. N minions are invited and numbered by $1, 2, \ldots, N$. Chocolate and vanilla gelatos are served at the banquet. Each minion has his own preference, he may eat only chocolate or only vanilla gelato or accept both.

There are P pairs of minions who dislike each other. They will fight when they are served the same type of gelato. Fortunately, these P pairs are so particular that minions can always be divided into 2 groups such that no two minions in the same group dislike each other.

Minions love bananas. If the i-th minion can be served g_i bananas instead of gelatos, he will not fight with others anymore. As banana is much more expensive than gelato, Dr. Nefario has to decide how to serve the banquet with minimum total bananas while still possible to avoid fights.

Input

The input consists of multiple (at most 5) test cases. For each test case:

- The first line contains 2 integers N, P ($1 \le N \le 1000$, $0 \le P \le 10^4$).
- The second line contains N integers $g_1, g_2, \ldots, g_N$ ($1 \le g_i \le 10^6$).
- The third line contains N integers $q_1, q_2, \ldots, q_N$ ($1 \le q_i \le 3$): $q_i = 1$ means the i-th minion eats only chocolate gelato; $q_i = 2$ means he eats only vanilla one; and $q_i = 3$ means he accepts both.

Each of the following P lines contains 2 integers a_i, b_i, which denotes minion numbered a_i and b_i dislike each other ($1 \le a_i, b_i \le N$).

Output

For each test case, print one integer which denotes the minimum total bananas served.

Example

stdin	stdout
2 1 10 10 2 2 1 2 3 2 3 3 2 2 1 3 1 3 2 3 3 0 1 1 1 3 3 3	10 2 0

Problem B. Skiing Map

Input file:	stdin
Output file:	stdout
Time limit:	1 second
Memory limit:	512 megabytes

Elsa – the queen of Arendelle wants to create a winter wonderland to play with her sister Anna, even in summer time! With her unique ability to create and control ice and snow, she plans to design skiing trails of great gliding challenges.

Let consider the area where Elsa locates her wonderland as a $2D$ plane, and $P_1(x_1, y_1)$, $P_2(x_2, y_2)$, ..., $P_N(x_N, y_N)$ be a sequence of N different points in the plane with nonnegative integer coordinates. She supposes that a skiing trail is *challenging* if in this sequence, for any two points $P_i(x_i, y_i)$ and $P_{i+1}(x_{i+1}, y_{i+1})$ (for $1 \le i < N$), it is justified that $x_i \le x_{i+1}$ and $y_i \ge y_{i+1}$. For example, the sequence of points $P_1(0, 5)$, $P_2(0, 4)$, $P_3(1, 3)$, $P_4(2, 3)$, $P_5(3, 0)$ forms a great gliding challenge.

Elsa has found a dozen of such challenging trails, and it seems there are many more. With limited time left for preparation, Elsa ought to set some constraints for the trails. To give her a hand, can you tell her number of challenging sequences of points for which all of these equations are justified: $x_1 + y_1 = w_1$, $x_2 + y_2 = w_2$, ..., $x_N + y_N = w_N$?

Input

The positive integer N ($1 \le N \le 10^4$) is given on the first line of the standard input. There are N nonnegative integers on the second line $w_1, w_2, \ldots, w_N$ separated by a single space ($0 \le w_i \le 10^4$ for $1 \le i \le N$ and $w_i \ne w_{i+1}$ for $1 \le i < N$).

Output

On a line of the standard output, print by modulo 20151011 the number of satisfied sequences.

Example

stdin	stdout
2 3 1	3

Explanation: There are 3 challenging sequences:

- $(0, 3)$, $(0, 1)$
- $(0, 3)$, $(1, 0)$
- $(1, 2)$, $(1, 0)$

Problem C. Cups and Balls

Input file:	`stdin`
Output file:	`stdout`
Time limit:	1 second
Memory limit:	512 megabytes

Cups and Balls is a classic performance of magic, with various adaptations around the world. The most widely performed version is:

> There are 3 identical cups set down in a line on a table. Initally, a ball is concealed under the middle cup. The magician will quickly and magically swap the cups for a number of times. After that, the audience will guess where the ball is.

Here is the Minion's version: There are N identical cups set down in a line on a table. Under each cup is a ball labelled with a natural number in range $[1, N]$. These N numbers are distinct; and initially the cups are arranged from the left-hand side to the right-hand side such that the numbers form an ascending sequence.

The magician will perform T turns, which can be described as a triple $i\ j\ k$:

- First, reverse all cups from position i to position j in the line.
- Then, the audience should tell the ball concealed under the cup at position k is labelled with what number.

You are invited by Dave – the smartest minion in town to play the audience role.

Input

The first line of input contains 2 integers N, T ($1 \le N \le 10^5$, $1 \le T \le 50\,000$). Next T lines, each contains a triple $i\ j\ k$ ($1 \le i < j \le N$, $1 \le k \le N$) as described above. Numbers on the same line are separated by spaces.

Output

Print T lines, i-th line contains the corresponding answer for i-th turn in input.

Example

stdin	stdout
5 3 1 3 3 4 5 4 2 4 1	1 5 3

Explanation:

- Initial sequence: 1 2 3 4 5
- After the first turn: 3 2 **1** 4 5
- After the second turn: 3 2 1 **5** 4
- After the third turn: **3** 5 1 2 4

Problem D. Save My Brother

Input file:	stdin
Output file:	stdout
Time limit:	1 second
Memory limit:	512 megabytes

Hiro was very proud to demonstrate his microbots at the university's science fair. However, he soon faced a tragedy that his older brother Tadashi was killed in the explosion in the university when he tried to rescue Professor Callaghan.

In the last part of the movie, Baymax used his armor's rocket fist to propel Hiro and Abigail out of the portal while it was left inside the portals space. It was so sad!

However, a few months later, Hiro receives a special message sent by Baymax inside the portals space. The message tells Hiro that both his brother Tadashi and Baymax are now safe somewhere in the universe. To rescue them, Hiro should build several Worm Tunnels to travel quickly in the universe. There are N possible Worm Tunnels. It takes c_i energy units to establish the i^{th} tunnel. If Hiro builds the i^{th} tunnel, for all points (x, y) in the universe and a nonnegative number k, he can travel from (x, y) to $(x + ka_i, y + kb_i)$.

Hiro is very enthusiastic to see his brother Tadashi and Baymax again. Therefore, he should compute the minimum total energy units to establish Worm Tunnels so that he can travel between any two points in the universe.

Input

First line of the input contains one integer N ($1 \le N \le 2 \cdot 10^5$). Then N lines follow; i^{th} of these lines contains three integers a_i, b_i, c_i ($-10^9 \le a_i, b_i \le 10^9, 1 \le c_i \le 10^9$).

Output

Print the minimum total energy units Hiro should use to build Worm Tunnels in order to be able to move between any two points in the universe. If this is impossible, print `-1` instead.

Example

stdin	stdout
3 0 1 1 0 0 1 1 -1 2	-1
5 10 2 5 0 1 20 1 0 11 0 -1 2 -1 0 3	10

Problem E. Wizard-of-Oz's Spells

Input file:	`stdin`
Output file:	`stdout`
Time limit:	1 second
Memory limit:	512 megabytes

In the magic land of Oz, wizards are taught a list of spells since they were young. The Oz spells are strings, which consist only of letters o and z. Furthermore, for all Oz strings, the following property is true:

If we denote by nO the number of o's and by nZ the number of z's in the string, then for every substring of the Oz string, it should be true that $|nZ - nO| \leq 3$ for this substring. For example, the string $ozozzo$ is an Oz string; while the string $ozzzzzo$ is not an Oz string because it contains the substring $zzzzz$ and for this substring $|nZ - nO| = 5$, which is greater than 3.

If we sort the Oz strings by length and then lexicographically we will obtain a sorted list of the Oz strings. The K^{th} Oz string is the one that is in the K^{th} position, starting from one, in this list. The first 10 strings of this list are: $\{o, z, oo, oz, zo, zz, ooo, ooz, ozo, ozz, ...\}$. As the list is too long for a novice wizard like Quinlan, can you help him to recall the K^{th} Oz string?

Input

On the first and only line of the standard input is a number K $(1 \leq K \leq 10^{14})$ the position of the Oz string that Quinlan wants to recall.

Output

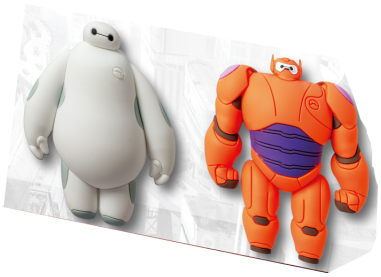
On the first and only line of the output, print the K^{th} Oz string.

Example

stdin	stdout
8	ooz

Problem F. Baymax Insider Expo

Input file:	`stdin`
Output file:	`stdout`
Time limit:	1 second
Memory limit:	512 megabytes



In memory of his brilliant brother Tadashi – the creator of Baymax, Hiro organizes an annual Expo with healthcare robots as the central theme. Learning from the experience of last Autumn Lantern Exhibition, Hiro also displayed robots in several lines arranged by their heights. However, as each kiosk at the Expo is too small, this plan did not hold. Hiro had to figure out another way.

There are N robots to be displayed. Given that the heights of these N robots are distinct integers with values in range $[1, N]$. Hiro decided to display all of them in a single line from the left-hand side to the right-hand side, with a special arrangement that brought most attraction to visitors. Accidentally, few hours before the opening day, his computer was crashed and all details about the arrangement were lost!

Now, the only way for Hiro to recover that arrangement is investigating some notes written by his assistant. Assume that the arrangement can be denoted by a sequence of N robots' heights $p(1), p(2), \ldots, p(N)$. An assistant's note consists of $R_{min} + R_{max}$ records in form (s_i, e_i, h_i), which are listed in below order:

- For each of the first R_{min} records, (s_i, e_i, h_i) means $\min\{p(s_i), p(s_i + 1), \ldots, p(e_i)\} = h_i$;
- For each of next R_{max} records, (s_i, e_i, h_i) means $\max\{p(s_i), p(s_i + 1), \ldots, p(e_i)\} = h_i$.

Please help Hiro to recover the final arrangement from the records, or tell him that the records contain contradictions. If there are more than one valid sequences, just show one with the smallest lexicographical order.

A sequence $p(1), p(2), \ldots, p(N)$ is lexicographically smaller than $q(1), q(2), \ldots, q(N)$ if and only if there exists $1 \le i \le N$ which $p(i) < q(i)$ and for all $1 \le j < i$, $p(j) = q(j)$.

Input

The input consists of multiple notes (at most 5) that Hiro wants to investigate. For each note:

- The first line contains 3 integers N, R_{min}, R_{max} ($1 \le n \le 50$, $0 \le R_{min} + R_{max} \le 50$).
- Each of the following $(R_{min}+R_{max})$ lines contains 3 integers s_i, e_i, h_i ($1 \le s_i \le e_i \le N, 1 \le h_i \le N$).

Output

For each note, print N integers $p(1), p(2), \ldots, p(N)$ separated by a single space, which denote the smallest lexicographical sequence; or `Impossible` if records contain contradiction.

Example

stdin	stdout
8 1 1 3 5 2 3 5 2 3 2 2 1 3 1 2 3 1 1 3 3 2 3 3	Impossible 2 1 3

Problem G. Anywhere Door 2.0

Input file:	`stdin`
Output file:	`stdout`
Time limit:	2 seconds
Memory limit:	512 megabytes

Anywhere Door is one of the most famous gadgets of Doraemon. When you want to go to somewhere, just tell the door, then open and go through it. The location behind the door is your expected destination. This magic door, however, has certain limitation. Namely, it cannot be used if it has been exposed to strong electromagnetic waves like solar winds. Or the door has only one instance and is always kept inside Doraemon's pocket; thus there is no way for Nobita to use the door when Doraemon is not beside him.

Being aware of such limitation, Doraemon is about to upgrade his door to the next version. In version 2.0, the Anywhere Door is a portable and reflective device. Suppose that the Earth map can be modelled as a $2D$ plane, where places are points with integer coordinates. The Anywhere Door device provides a list of N actuators placed at N different coordinates (x_i, y_i) $(1 \le i \le N)$. And it functions with the following behavior: when one stays at (u, v) and decides to use the actuator at (x_i, y_i), then he or she will be magicially moved to a destination at $(2x_i - u, 2y_i - v)$.

Doraemon is not so good at implementation, you are trusted to write a program to verify his device. Herein, Nobita will give you a list of test cases, each of which is asked to check if there is a path from his home at (x_S, y_S) to a destination (e.g., Shizuka's house) at (x_E, y_E).

Good luck to Doraemon, and wish his device early released!

Input

The first line contains one integer T $(1 \le T \le 10^5)$ – the number of test cases in the input. Description of each test is as following:

- Each test consists of $N + 3$ lines.
- The first line contains one integer N $(1 \le N \le 10^5)$ - the number of actuators.
- The following $N+2$ lines contain two integers x, y $(-10^3 \le x, y \le 10^3)$ – coordinates of N actuators, Nobita's home (x_S, y_S) and someone's house (x_E, y_E) respectively.

It is guaranteed that the sum of N in all the test cases does not exceed 10^5.

Output

For each test case, if Nobita can get to the destination print `YES`, otherwise print `NO`.

Example

stdin	stdout
2 2 1 1 1 3 1 1 1 3 3 -1 1 1 1 1 -1 0 0 0 4	NO YES

Explanation: For the second test case, Nobita starts at $(0, 0)$ and uses actuator $(1, -1)$ to move to $(2, -2)$. Then from $(2, -2)$, he uses actuator $(1, 1)$ to reach someone's house at $(0, 4)$.

Problem H. WICKED Is Good?

Input file:	`stdin`
Output file:	`stdout`
Time limit:	1 second
Memory limit:	512 megabytes

Thomas is a brave young man who has made an amazing escape from the hand of WICKED - an organization which uses human as the experimental subject. However, one of his best friends named Minho was caught in the last fight. As a result, Thomas decided to fight back. With a short inspirational speech, he surprisingly became the head of the Right Arm - an armed group formed by people who escaped from WICKED.

The Right Arm decided to battle from the inside, which means that they need access to all the security doors. Since all the people in the Right Arm used to be in WICKED, they can remember some of the access codes in there. However, the security system works in a unusual way:

- Step 1: enter the access code L.
- Step 2: press the OK button. L will be displayed on the screen.
- Step 3: press the OK button again. The system calculates the sum of the current number displayed on the screen and the access code L. It means that after the second time, the result will be $L + L$
- Continue pressing the OK button until we get a number which consists of equal digits only.

Since time is not on their side, Thomas wants to make sure if they could reach a valid number from a particular access code.

Input

A single line containing a positive integer L ($1 \leq L \leq 999$) - the access code.

Output

If it is impossible to reach a valid number from the given access code, print `'I don't know!'` (without quotes). Otherwise, print a pair of two integers *digit* and *length* denoted the digit and the length of the valid number.

Example

stdin	stdout
74	2 3
50	I don't know!

Explanation: $74 + 74 + 74 = 222$.

Problem I. Coming Home

Input file:	`stdin`
Output file:	`stdout`
Time limit:	3 seconds
Memory limit:	512 megabytes

Riley is a lovely eleven-year-old girl. However, when her family moves to a new city, she becomes sad as she really misses her old life. Eventually, she prepares to leave her parents and to board a bus to go back to her old house! Joy, Sadness, Disgust, Fear, and Anger are the **five core emotions** of Riley. Now they have to bring Riley back to her parents.

There are N personality islands in Riley's mind. There are roads to connect all islands. However, because Riley is really sad, many roads have been broken. Currently all personality islands are connected with only $N-1$ roads.

The personality islands are numbered from 1 through N. The island 1 is the Headquarter (the root). For each personality island i, the predecessor of that island is p_i and the distance between i and p_i is d_i.

To restore the stability state for all personality islands so that Riley will return to her house and share her feeling with her parents, the five emotions (Joy, Sadness, Disgust, Fear, and Anger) must quickly send a special signal via *train of thought* from one island to all islands (from 1 to k where $1 \le k \le N$).

For each value of k, please help the five emotions to choose the best personality island where they can start to send the signal to all islands from 1 to k. The best island is the island with the minimum total distances for that island to all other islands

$$\min_{1 \le v \le N} \{ \sum_{i=1}^{k} dist(i, v) \}$$

where $dist(i, v)$ denotes the distance between the two personality islands i and v.

Input

First line of the input contains one integer N ($1 \le N \le 2 \cdot 10^5$). Then $N-1$ lines follow, i^{th} of them contains two integers p_{i+1} and d_{i+1} – predecessor of an island $i+1$ and the distance between $(i+1)^{th}$ island and its predecessor ($1 \le p_i \le N$, $1 \le d_i \le 2 \cdot 10^5$, the graph represented by p_i is a tree).

Output

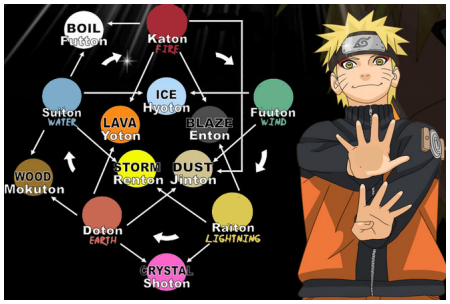
Print N lines. In the i^{th} line, print the answer when $k = i$.

Example

stdin	stdout
5 1 1 1 2 2 3 4 1	0 1 3 7 11

Problem J. When A Fighter Has To Think

Input file:	`stdin`
Output file:	`stdout`
Time limit:	1 second
Memory limit:	512 megabytes



Hidden Leaf Village is considered as the most powerful ninja village in the Land of Fire. This village is the symbol of peace in the ninja world. They provide N ninjas for ordered tasks but they are also responsible for national requests like protecting the kings. The ninjas are numbered from 1 to N.

Naruto - the hero of the ninja world after the world war against Madara - is considered to be promoted as the seventh Hokage (Hokage is the head of the Hidden Leaf Village). In order to make sure that Naruto is mature enough to lead the village, the council decides to give him the final test: to identify the natural elements of all the ninjas in the village.

There are five elements named Fire, Lightning, Water, Wind, Earth. There is an relationship between any pair of two elements - a supportive one or an opposite one. There are five supportive relationships: Wind supports Fire, Fire supports Water, Water supports Earth, Earth supports Lightning and Lightning supports Wind. There are also five opposite relationships: Wind restricts Water, Water restricts Lightning, Lightning restricts Fire, Fire restricts Earth and Earth restricts Wind.

Naruto knows that he is numbered 1 and Wind is his natural element. He also has access to the database which contain details about all the missions in the past. However, he cannot find anything about the natural element of each ninja. The only useful thing is the result of M tests of relationship between the ninjas. A test result is described in one of the 5 following ways:

- 0 A B: means that ninja A and ninja B have the same natural element.
- 1 A B: means that ninja A restricts ninja B.
- 2 A B: means that ninja B supports ninja A.
- 3 A B: means that ninja A supports ninja B.
- 4 A B: means that ninja B restricts ninja A.

Please help Naruto to check if there is any errors in the database. If not, he wants to know the minimum number of tests he still has to perform in order to find the natural elements of all the ninjas.

Input

- The first line contains an integer T ($1 \leq T \leq 30$) - the number of test cases.
- The first line of each test case contains two integers N, M ($2 \leq M, N \leq 10^5$) - the number of ninjas and the number of tests respectively. Then there are M lines following.
- Each line contains three integers res, A, B ($0 \leq res \leq 4$, $1 \leq A, B \leq N$, $A \neq B$) denotes the result of the test following the format described above.

Output

For each test case, print the minimal number of tests Naruto still needs to perform. If there is some error in the database, print `"-1"` (without quotes).

Example

stdin	stdout
2 5 4 1 1 2 4 2 3 0 3 4 2 4 5 6 3 1 1 3 1 3 1 0 2 4	0 -1

Explanation: In the first case, Naruto can figure out that 1 is Wind (because that's him), 2 is Water, 3 is Wind, 4 is Wind and 5 is Lightning, so he will not need any more information. In the second case, there is an error in the first two tests.