The 16th Harbin Engineering University Collegiate Programming Contest

April 25, 2021

Problems

Do not open before the contest has strated!

附页：部分词汇

前言

- 在本次校赛中，出题组将使用英文题面。这一决定主要基于推动校赛标准化的考虑。尽管如此，我们希望各位并不因此畏缩——事实上，即使是在 ACM 区域赛赛场上，无法通过四级的参赛选手也并不鲜见。ACM 考察算法能力，但也顺便考察英语水平，考虑到前者显然比后者更加劝退，我们相信，对于一个有志于 ACM 的参赛选手来说，语言障碍是易于克服的，尤其是在允许带词典的情况下。
- 尽管如此，为了校赛标准化的进程更加平滑，我们打算暂且放松要求。我们将在下方解释题面中的某些单词。如果你仍然无法理解题意，请使用 Clarification 功能请求关于题意的帮助（尽管这种请求在更加正式的比赛中是会被忽略的）。

词汇表（字典序）

- adjacent – 相邻的；*Aka.* (As known as) – 也被称为；
- assign – 指定；automatically – 自动地；
- blast – 炸；bonus – 额外得分；by then – 到那时为止；
- cell – 格子；commission – 委托；constraints – 限制；
- continuously – 连续地；corresponding – 对应的；
- defensive – 后手的；deliberately – 故意地；diamond – 菱形；
- dilemma – 窘境；disgusting – 令人厌恶的；distinct – 不同的；
- distribution – 分配；dotted line – 虚线；
- equilateral triangle – 正三角形；execution – 执行；
- expectation/expected value – 期望值；
- flip – 翻转；forge – 锻造；form – 形成；
- formally – 形式化地；full line – 实线；
- gather – 聚集；glide – 滑翔；gradually – 逐渐地；
- grid – 网格；guarantee – 保证；
- *i. e.* (id est)– 即；impact – 影响；index – 编号；
- lowercase Latin latter – 小写拉丁字母(a~z)；launch – 发起；
- leave – 叶子（即仅与一个结点直接相连的结点）；
- material – 材料；maximize – 最大化；maximum – 最大的；
- meteorite – 陨石；minimize – 最小化；minimum – 最小的；
- namely – 即；node – 结点；
- offensive – 先手的；optimal – 最佳的；overlap – 重叠；
- palindromic – 回文的；previous – 之前的；prime – 质数；priority – 优先级；
- queue – 队列；
- reasonable – 合理的；relevant – 相关的；
- respectively – 分别地；rotate – 旋转；route – 路线；
- sequence – 序列；specifically – 具体地；storage – 存储；
- strategy – 策略；successively – 依次地；synthetize 合成；
- talent – 技能；trivial – 琐碎的；
- uniformly – 均匀地；

Problem A. stral Reflection

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	1024 megabytes

I am Astrologist Mona Megistus, meaning "The Great Astrologist Mona." If it is divination you seek from me, then I ask you respect my name by learning it wholly, here and now.

—Mona

This is the easy version of *Problem M. abushii Omoi*. It's guaranteed that in this version $w = 1$ for all talents.

In event *Unreconciled Stars*, some meteorites fell on Teyvat and confused people's minds. In order to protect the people of Teyvat, Mona needs to clean up these meteorites.

Teyvat can be represented by a line $[1, n]$, and meteorites can be represented by some points in this line. For clearing meteorites, Mona can use some types of her talents. A talent can be represented by three integers l, r, w, which means Mona can spend w Power clearing all meteorites in $[l, r]$ by using this talent. At the beginning, Mona has no talent, but she will learn gradually.

Mona wants to spend as few Power as possible. For each wave of meteorite shower, Mona wants to know if she can clean up all the meteorites by using the talents she has mastered by then, and if yes, what the minimum possible Power it requires to clean all of them. More specifically, there will be two types of operation:

- `1 l r w`: Mona learns a new talent to clear all meteorites in $[l, r]$ with w Power.
- `2 k a_1 a_2 ... a_k`: There are k meteorites in point $a_1, a_2, \ldots, a_k$. Mona needs to calculate the minimum power she needs to spend to clear these k meteorites, or point out that some of meteorites are impossible to clear.

Note: Meteorites from the previous wave will be cleared automatically, no matter if Mona succeeds in clearing all of them or not.

Input

The first line contains two integers n, m ($1 \le n, m \le 10^5$) — the size of Teyvat and the number of operations.

In the following m lines, each line will be in one of the following format as described in the statement:

- `1 l r w` ($1 \le l \le r \le n$, $w = 1$)
- `2 k a_1 a_2 ... a_k` ($1 \le k \le n$, $1 \le a_1 < a_2 < \cdots < a_k \le n$)

All of input are integers.

It is guaranteed that the sum of k for all operations does not exceed 10^5.

Output

For each operation of type 2, output the minimum power Mona needs to spend to clear these meteorites. If some of meteorites are impossible to clear, output -1.

Example

standard input	standard output
10 5 1 1 3 1 2 1 2 2 2 2 4 1 3 5 1 2 2 2 4	1 -1 2

Note

In the first example, operations are explained as follows:

- **Operation 1**: Mona learns a new talent to clear all meteorites in $[1, 3]$ with 1 Power.
- **Operation 2**: There is 1 meteorite in point 2. Mona can spend 1 Power using talent $[1, 3]$ to clear up it.
- **Operation 3**: There is 2 meteorites in point $2, 4$ respectively. Mona can spend 1 Power using talent $[1, 3]$ to clear up meteorite in point 2, but she can't clear up meteorite in point 4.
- **Operation 4**: Mona learns a new talent to clear all meteorites in $[3, 5]$ with 1 Power.
- **Operation 5**: There is 2 meteorites in point $2, 4$ respectively. Mona can spend 2 Power totally using talent $[1, 3]$ and $[3, 5]$ to clear up them.

The meteorites that have rained down were once, in fact, part of someone's constellation. Why did this ancient array of stars fall from the sky? What goal were their extinguished flames chasing? Armed with the courage to face the answers, you march onward.

Problem B. lazing Riff

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

Xinyan's the name, an' rock 'n' roll's the game — and I'm the only one who plays it in Liyue Harbor. Been thinking about staging concerts elsewhere lately, but... Hmm... Well, word is that you've been all over the place, Traveler. So, what say you sign me up for your world tour? Anywhere's good!

—Xinyan

Xinyan is fond of passionate music.

Let's use string consisted of only lowercase Latin letters to represent each piece of music. If the corresponding string is palindromic, Xinyan thinks it's boring; Otherwise, Xinyan thinks it's exciting.

Recall that **a string is palindromic if it reads the same backward as forward.** For example, `madam` and `racecar` are palindromic, when `direct` and `test` are non-palindromic.

For each piece of music, if we delete 0 or more letter(s) from the beginning of the corresponding string, and delete 0 or more letter(s) from the ending of the corresponding string, then the non-empty result is called a **part** of this music. In addition, we define the length of a part as the length of its corresponding string.

For given music, Xinyan wants to calculate the length of its shortest exciting part, or point out that there is no exciting part.

Input

The only line contains a string s ($1 \leq |s| \leq 100$), consisted of lower Latin letters only, and means the given music.

Output

Output the length of the shortest exciting part in the given music. If there is no exciting part, output `-1`.

Examples

standard input	standard output
a	-1
aaa	-1
aabaa	2

Note

In the first example and the second example, there is no exciting part.

In the third example, there are some exciting parts like `ab` or `ba`, whose length is 2. It can be shown that these two parts are the shortest exciting parts.

Rock 'n' roll is a relatively unpopular style of music in Liyue, having recently been brought over from Fontaine. Xinyan, however, loves the sound — and she's slowly but surely amassing a fanbase of her own as she performs throughout Liyue Harbor.

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Problem C. hivalric Blossom

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

My name is Noelle, maid of the Knights of Favonius, and it's my pleasure to be joining you on your adventure today. Should you encounter any problems at any point throughout your journey, please do not hesitate to call me and I will be delighted to provide you with my full assistance. Yes, starting right now — what do you need?

—Noelle

Noelle is a polite young woman and professional maid, helping those in need without hesitation. Although Noelle is not an official knight of the Knights of Favonius, people in Mondstadt often come to her for help.

As busily as usual, Noelle receives n commissions, indexed from 1 to n. Because different commissions have different levels of importance, Noelle needs to assign a priority to each commission. After that, she will complete the commission successively in **increasing** order of priority. If some commissions share the same priority, Noelle will firstly complete the commission with smaller index.

Some of the commissions are highly relevant, so Noelle wants to complete them continuously without a break. Formally, such constraints are represented by m pairs $(l_1, r_1), (l_2, r_2), \ldots, (l_m, r_m)$ — If the index of Noelle's k-th commission is l_x, then the index of her $k+1$-th commission should be r_x. Noelle doesn't want to remember many diffierent level of priorities, so she wants to minimize the number of different level of priorities while the above constraints are satisfied.

Input

The first line contains two integers n, m ($1 \le n \le 10^5$, $0 \le m \le n-1$) — the number of commissions and the number of constraints.

The i-th line in following m lines contains two integers l_i, r_i ($1 \le l_i < r_i \le n$), which describes the i-th constraint.

It is guaranteed that Noelle's constraints always can be satisfied with reasonable priority distribution. Namely, all of l_i will be distinct and all of r_i will be distinct.

Output

Output n integers, the i-th integer is w_i ($1 \le w_i \le 10^9$) — the priority of the i-th commission, such that the constraints are satisfied.

If there are multiple solutions, output any one of them.

Examples

standard input	standard output
6 2 1 3 2 6	1 2 1 1 1 2
6 2 1 4 2 6	1 2 3 1 1 2
10 6 1 3 3 7 2 10 4 6 6 9 5 8	3 4 3 1 2 1 3 2 1 4
3 0	1 1 1

Note

In the first example, Noelle's execution order is $[2, 6, 1, 3, 4, 5]$, so $(1, 3)$, $(2, 6)$ can be continuous pairs. The number of different priorities is 2.

In the second example, Noelle's execution order is $[1, 4, 5, 2, 6, 3]$, so $(1, 4)$, $(2, 6)$ can be continuous pairs. The number of different priorities is 3.

In the third example, Noelle's execution order is $[4, 6, 9, 5, 8, 1, 3, 7, 2, 10]$, so all pairs are satisfied. The number of different priorities is 4.

Noelle has much greater dreams and ambitions than other maids in the Knights of Favonius. Like anyone else in this city protected by the Knights of Favonius, she too dreams of donning the honored armor. Even if her skills are not enough to pass the rigorous selection trials, she still wishes to observe and learn from them every chance she gets. Aside from her training, she enjoys her current life, helping everyone in need. "You can leave absolutely anything to me!" That's her signature line. If there's anything that you need, Noelle is glad to be of help.

Problem D. andelion Knight

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

I am Jean, the Dandelion Knight, requesting approval to join your party. From this day onwards, my honor and loyalty lie with you.

—Jean

As the acting Grand Master for the Knights of Favonius, Jean takes all of her responsibilities and duties associated with the role seriously, regardless of how trivial the tasks may seem to her, such as finding a lost cat.

As usual, Jean accepts commissions from Mondstadt and Springvale respectively. There are n commissions from Mondstadt in a queue that must be finished in order, *i.e.* the first commission must be finished before Jean can start working on the second commission. Similarly, there are n commissions from Springvale in a queue that also must be finished in order.

Different commissions have different impact values. For each of commission, it can be either impactful (with impact value 1), or trivial (with impact value 0). At the end of today, if the sum of impact values of finished commissions from Mondstadt doesn't equal to the sum of impact values of finished commissions from Springvale, it will create a dilemma for Jean and Jean wants to avoid that.

Define $f(x)$ as the number of ways for Jean to avoid dilemma if she will finish **exactly** x commissions totally at the end of today. For $x \in [0, 2n]$, calculate $f(x)$.

Two ways are considered different if one or more commissions are finished in one way but unfinished in another way.

Input

The first line contains one integer n ($1 \le n \le 10^6$) — the number of commissions in each place.

The second line contains n integer $a_1, a_2, \ldots, a_n$ ($a_i \in \{0, 1\}$), which means impact value of the i-th commission in Mondstadt.

The third line contains n integer $b_1, b_2, \ldots, b_n$ ($b_i \in \{0, 1\}$), which means impact value of the i-th commission in Springvale.

Output

Output $2n + 1$ integers $f(0), f(1), \ldots, f(2n)$ in a single line.

Examples

standard input	standard output
2 0 1 1 0	1 1 0 1 1
5 0 0 1 1 0 1 1 0 0 1	1 1 1 0 1 0 1 2 2 1 0

Note

The first example is explained as following:

- When $x = 0$: The only way is to finish none of commissions. The impact value in both Mondstadt and Springvale is 0.
- When $x = 1$: The only way is to finish 1 commission in Mondstadt. The impact value in both Mondstadt and Springvale is 0.
- When $x = 2$: It can be shown it's just impossible to make the impact value in Monstadt and Springvale equal if Jean finish two commissions, so the number of ways is 0.
- When $x = 3$: The only way is to finish 2 commissions in Mondstadt and 1 commission in Springvale. The impact value in both Mondstadt and Springvale is 1.
- When $x = 4$: The only way is to finish all commissions. The impact value in both Mondstadt and Springvale is 1.

The second example is partly explained as following:

- When $x = 8$: The first way is to finish 4 commissions in Mondstadt and 4 commissions in Springvale. The second way is to finish 5 commissions in Mondstadt and 3 commissions in Springvale. They are considered as two different ways because $(4, 4) \neq (5, 3)$. In these two ways, the impact value in both Mondstadt and Springvale is 2.

Recall that **two ways are considered different if any of the commission is not finished in one way but is finished in another way.**

As the Acting Grand Master of the Knights, Jean has always been devoted to her duties and maintaining peace in Mondstadt. She had taken precautions long before the onset of Stormterror's assault, and she will guard Mondstadt with her life as always.

Problem E. clipsing Star

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

I am Ningguang, Tianquan of Qixing. You wish to trade? You be my personal bodyguard, and I will show you how to get ahead in Liyue.

—Ningguang

As Tianquan of the Liyue Qixing, Ningguang holds a position of wealth beyond many others in Teyvat, and represents fortune and wit.

Today, you're launching a challenge to Ningguang. The rules are as follows:

- There will be n rounds. In the i-th round, there will be a_i Mora.
- In the first round, you are the offensive player and Ningguang is the defensive player.
- In the i-th round, the offensive player can choose a integer b_i ($b_i \in [0, a_i]$), then, the offensive player will get b_i Mora and the defensive player will get $a_i - b_i$ Mora.
- After that, there is $\frac{b_i}{a_i}$ probability that two players exchange positions — the offensive player becomes defensive player and the defensive player becomes offensive player.

In this challenge, both you and Ningguang are clever enough to take the best strategy to get more Mora. Define x as the expectation of Mora you get, and y as the expectation of Mora Ningguang gets. Now, you want to calculate the maximum value of $x - y$.

Your answer will be considered correct, if its absolute or relative error does not exceed 10^{-4}. More formally, if your answer is a and jury's answer is b, your answer will be considered correct if $\frac{|a-b|}{\max(1,b)} \leq 10^{-4}$.

Input

The first line contains a single integer n ($1 \leq n \leq 10^6$), which means there will be n round in this challenge.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \leq a_i \leq 10^9$), which means there will be a_i Mora in the i-th round.

Output

Output a single real number — the maximum value of $x - y$.

Examples

standard input	standard output
2 10 5	5.0000000000
3 10 5 20	5.0000000000
6 1 1 4 5 1 4	0.0000000000

Note

The first example is explained as following:

- In the first round, you can get all of 10 Mora directly and left nothing.
- Then, in the second round, although there is 100% probability for Ningguang to become the offensive player, she can only get 5 Mora as most.
- So, you get 10 Mora totally, Ningguang gets 5 Mora totally. The answer is $x - y = 10 - 5 = 5$.

It's not difficult to prove that it's impossible to make answer greater than 5 in the first example.

> *Ningguang is a professional businesswoman, having accumulated her wealth through hard work and perseverance, with the Jade Chamber being the pinnacle of her work. While maintaining law and order in Liyue as the Tianquan, Ningguang always looks for good opportunities with her business wit. Despite her wealth, she dislikes excess extravagance and uses her accumulated mora wisely.*

Problem F. leeing Sunlight

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

Spark Knight Klee of the Knights of Favonius, reporting for duty! ...There's some more, but uh, I forgot. I'm not so good at remembering...

—Klee

Klee's definition of playing is throwing explosives all over the place; she is particularly fond of "fish blasting" — throwing bombs in lakes full of fish.

Today, Klee also plans to blast fish in Starfell Lake. There are n fish in Starfell Lake. Klee will use a bomb with power x, then, every fish whose HP less than or equal to x will be blasted.

However, Klee doesn't know HP of every fish. Instead, she only knows HP of the i-th fish is a uniformly random real number in $[l_i, r_i]$. Now, Klee wants to determine minimum possible x such that the expected number of blasted fish is greater or equal to m.

Your answer will be considered correct, if its absolute or relative error does not exceed 10^{-4}. More formally, if your answer is a and jury's answer is b, your answer will be considered correct if $\frac{|a-b|}{\max(1,b)} \leq 10^{-4}$.

Input

The first line contains two integers n, m ($1 \leq m \leq n \leq 10^5$) — the number of fish and Klee's expection of the number of blasted fish.

In the following n line, each line contains two real numbers l_i, r_i ($0 \leq l_i \leq r_i \leq 10^9$), which means HP of the i-th fish will be a random real number in $[l_i, r_i]$.

Output

Output minimum possible x such that the expected number of blasted fish is greater or equal to m.

Examples

standard input	standard output
2 1 1.4 2.8 1.4 2.8	2.1000000000
3 2 1.5 3.0 2.4 5.0 1.919810 1.919810	2.7804878048
1 1 0 1000000000	1000000000.0000000000

Note

In the first example, if Klee throws a bomb with power 2.1, the probability for blasting fish 1 is 0.5, the probability for blasting fish 2 is 0.5, so the expection of the number of blasted fish is $0.5 + 0.5 = 1$.

In the second example, if Klee throws a bomb with power $\frac{114}{41} \approx 2.7804878048$, the probability for blasting fish 1 is $\frac{35}{41}$, the probability for blasting fish 2 is $\frac{6}{41}$, the probability for blasting fish 3 is 1, so the expection of the number of blasted fish is $\frac{35}{41} + \frac{6}{41} + 1 = 2$.

> *Knights of Favonius Spark Knight! Forever with a bang and a flash! —And then disappearing from the stern gaze of Acting Grand Master Jean. Sure, time in solitary confinement gives lots of time to think about new gunpowder formulas...But it'd still be better to not be in solitary in the first place.*

Problem G. liding Champion

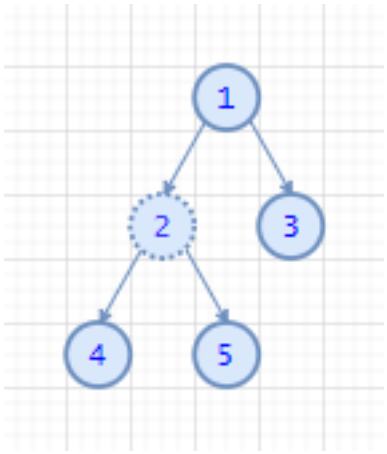
Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	512 megabytes

Outrider Amber reporting for duty! Just say the word if you ever need my help!

—Amber

Amber is a perky and straightforward girl. Her amazing mastery of the glider has made her a three-time winner of the Gliding Championship in Mondstadt. As a rising star within the Knights of Favonius, Amber is always ready for any challenging task.

Now, Amber is planning the routes of the new Gliding Challenge in Mondstadt. Mondstadt can be represented by a rooted tree with n nodes as buildings and $n-1$ edges as roads, and the root is node 1. In the Gliding Challenge in this year, a legal gliding routes should begin from the root, go along the road, end at a leave, and don't pass through a road more than once. For example, in the following picture, $1 \to 3$, $1 \to 2 \to 4$ and $1 \to 2 \to 5$ are legal routes; $1 \to 2$ and $1 \to 3 \to 1 \to 3$ are not.



As an organizer, Amber can set some nodes as bonus nodes while others not. When a challenger flies over a bonus node, he gets a bonus. In order to attract more challengers, Amber wants to set as many bonus nodes as possible, but to be fair, there should be as many bonus nodes on each legal route. Now, Amber wants to calculate the number of ways to set bonus nodes to satisfy the above constraints. As the result can be very large, you should output the answer modulo 998244353.

Two ways are considered different if a node is bonus node in one way when it's not bonus node in another way.

Input

The first line contains a single integer n ($2 \le n \le 10^6$) — the size of Mondstadt.

The i-th line in following $n-1$ lines contains two integers u_i, v_i ($1 \le u, v \le n$, $u_i \ne v_i$), which means there is a road between node u_i and node v_i in Mondstadt.

It is guaranteed the given input forms a tree.

Output

Output a single integer — the number of the ways to set bonus nodes to satisfy all constraints modulo 998244353.

Examples

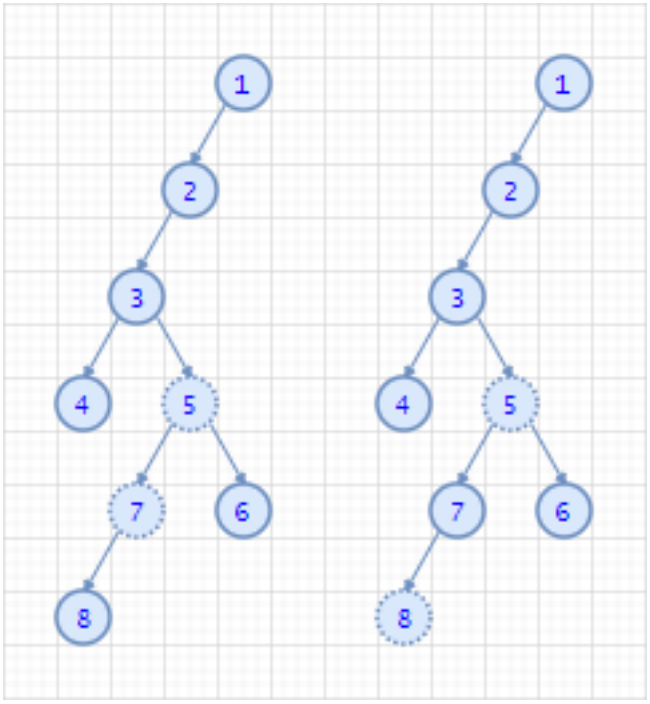
standard input	standard output
5 1 2 1 3 2 4 2 5	1
8 1 2 2 3 3 4 3 5 5 6 5 7 7 8	2

Note

We use circles of full line to represent bonus nodes and circles of dotted line to represent normal nodes.

The picture for the first example is shown in statement.

In the second example, there are 2 ways as following:



Recall that **two ways are considered different if a node is bonus node in one way when it's not bonus node in another way.**

> *Amber is described as an "exemplary of justice" by Kaeya. A righteous and accomplished knight, she fulfills her duties and does things by the Knights of Favonius handbook. She is as charismatic as she is kind, being able to see others' efforts to turn over a new leaf. Cheerful and friendly, Amber has no problem talking to strangers as if she's already acquainted with them. She is passionate in all things she does, be it when it comes to helping others as an Outrider or taking out hilichurl camps.*

Problem H. armless Sweetie

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

I'm Sucrose, a researcher of alchemy. I heard you've been to a lot of places, so I was wondering if you... Ah, what am I saying! It's only our first meeting, I shouldn't trouble you. But... If you're willing, I'd love to hear any stories you have about your adventures. I'd... really like that.

—Sucrose

Sucrose loves experimenting and spends most of her time researching on bio-alchemy, which means she has to do a lot of synthetic experiments.

Today, Sucrose is synthetizing a sequence a of length n, which is satisfied $a_i \in \{1, -1\}$. In one operation, she can synthetize two **adjacent** numbers a_i and a_{i+1} to a single number $a_i \cdot a_{i+1}$, and get $a_i \cdot a_{i+1}$ score then.

Obviously, after each operation, the length of a will be reduced by one. When the length of a becomes 1, Sucrose stops. Now, Sucrose wants to calculate the maximum score she can get when she stops.

Sucrose needs to do a lot of synthetic experiments, so you need to answer her queries for T times.

Input

The first line contains a single integer T ($1 \le T \le 10^5$) — the number of Sucrose's queries.

Each query contains two lines in the following $2T$ lines. In each query, The first line contains a single number n ($1 \le n \le 10^5$), which means the length of sequence a; The second line contains n number $a_1, a_2, \ldots, a_n$ ($a_i \in \{1, -1\}$).

It is guaranteed that sum of n across all queries does not exceed 10^5, *i.e.* $\sum n \le 10^5$.

Output

For Sucrose's each query, output a single integer — the maximum score Sucrose can get. Output T Lines totally.

Example

standard input	standard output
10 5 1 1 1 1 -1 4 1 1 1 -1 1 -1 1 1 10 -1 1 1 -1 1 1 1 -1 1 1 10 1 -1 1 1 -1 -1 1 -1 -1 -1 10 -1 -1 1 1 1 -1 1 -1 -1 -1 5 -1 -1 -1 -1 -1 5 1 1 1 1 1 8 -1 -1 1 -1 1 -1 -1 -1	2 1 0 0 5 7 7 2 4 5

Note

The 10-th example is explained as follows (we use underline to mark the numbers we choose to synthetize):

- $[\underline{-1, -1}, 1, -1, 1, -1, -1, -1]$
- $[1, 1, -1, 1, \underline{-1, -1}, -1]$
- $[\underline{1, 1}, -1, 1, 1, -1]$
- $[1, -1, \underline{1, 1}, -1]$
- $[1, -1, \underline{1, -1}]$
- $[1, \underline{-1, -1}]$
- $[\underline{1, 1}]$
- $[1]$

In these rounds, Sucrose gets $1, 1, 1, 1, -1, 1, 1$ score respectively, so she gets 5 scores totally.

Due to spending most of her time researching and experimenting, Sucrose is a recluse. She has trouble talking with others, as she worries frequently about unintentionally offending them. Lisa remarks that she is hopeless when talking to people, and she herself admits that she is scared of Jean to the point that she often asks Albedo to go on her behalf. However, she does not share the same issue when talking about bio-alchemy or Albedo. She reveres Albedo to the point that she considers he to be a true gentleman and maintains an excessively formal manner towards him, despite both of them being at a similar age.

Problem I. cy Resurrection

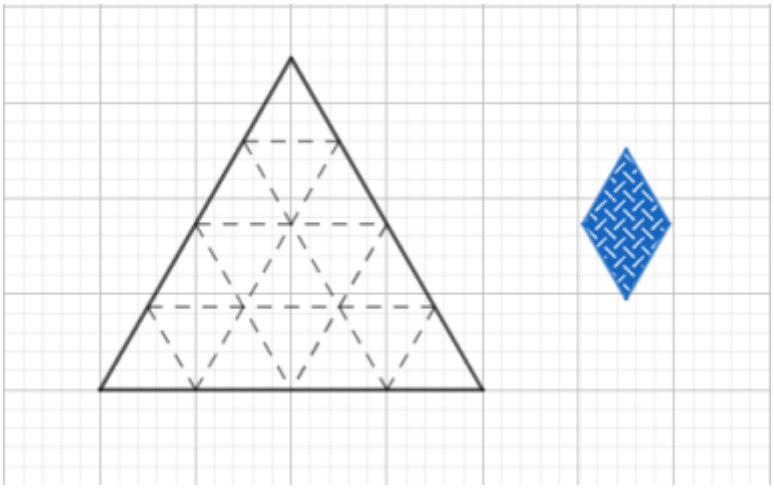
Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

I am Qiqi. I am a zombie. And I forgot what comes next.

—Qiqi

Bubu Pharmacy has a storage area, which is a equilateral triangle formed with sides of length n. This storage area can be regarded as a triangle grid, which can be divided into many cells (each cell is a equilateral triangle formed with sides of length 1).

Qiqi (*Aka.* Nana) has many same boxes with diamond shape, and each of them can fill two adjacent cells in the storage area. The following picture shows a storage area with $n = 4$ and the shape of Qiqi's box.



A storage area with $n = 4$, there are 16 cells in it; the shape of Qiqi's box.

Now, Qiqi wants to put her boxes in the storage area. However, Qiqi finds that it's impossible to completely fill the storage area with her boxes, there're always some empty cells which can't be filled with. Now, qiqi wants to calculate the minimum number of empty cells.

You need to answer Qiqi's queries for T times.

Input

The first line contains a single integer T ($1 \le T \le 100$), which means Qiqi will query for T times.

In the following T lines, each line contains a single integer n ($1 \le n \le 100$) — the side length of the storage area.

Output

For Qiqi's each query, output a single integer — the minimum number of empty cells. Output T Lines totally.

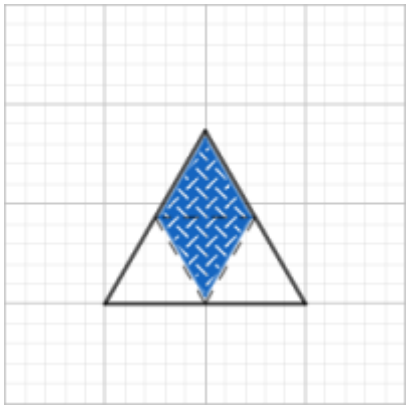
Example

standard input	standard output
3 1 2 4	1 2 4

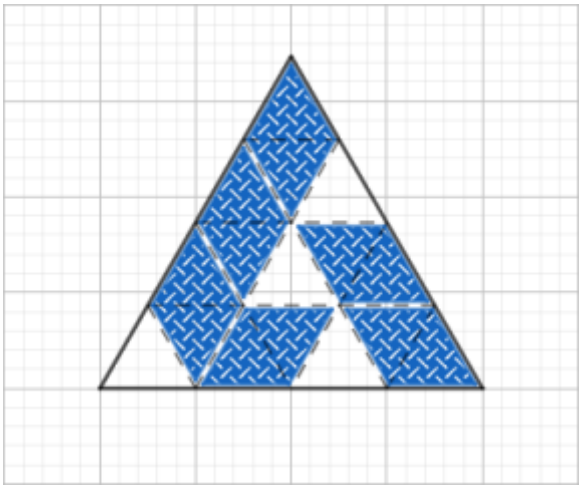
Note

In the first example ($n = 1$), it's impossible to put any box, so there are 1 cell left empty.

In the second example ($n = 2$), Qiqi can put 1 box at most, so there are 2 cells left empty. The following picture shows a way to put 1 box. There're also other ways to put 1 box but it can be shown it's impossible to put 2 boxes or more boxes.



In the third example ($n = 4$), Qiqi can put 6 boxs at most, so there are 4 cells left empty. The following picture shows a way to put 6 boxes. There're also other ways to put 6 boxes but it can be shown it's impossible to put 7 boxes or more boxes.



As is shown, boxes can be rotated, but shall not overlap with each other.

> *"Blessed" by the adepti with a body that cannot die, this petite zombie cannot do anything without first giving herself orders to do it. Qiqi's memory is like a sieve. Out of necessity, she always carries around a notebook in which she writes anything important that she is sure to forget later. But on her worst days, she even forgets to look at her notebook...*

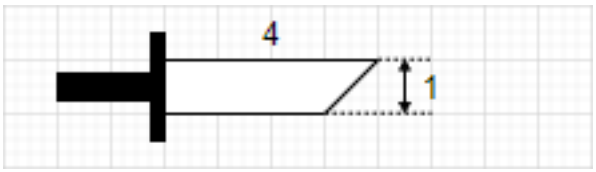
Problem J. uvenile Galant

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

Xingqiu at your service, my liege! I humbly trust that even one such as I, a mere bookworm, may yet prove to be of some utility under your wise leadership. Nice, I don't often get a chance to speak with such formality. It felt pretty good!

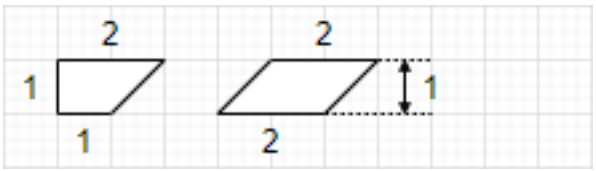
—*Xingqiu*

As a self-proclaimed practitioner of the Guhua Clan (*Aka.* Kokaha)'s arts, Xingqiu (*Aka.* Yukuaki) is planning to forge a longsword with length n. The following picture shows a longsword with length $n = 4$.



A longsword with length $n = 4$ (not really long though).

In order to forge his longsword, Xingqiu has gotten some materials. There are two types of materials, and Xingqiu has infinite pieces of both of them. The following picture shows the shapes of materials.



The shapes of materials.

Now, Xingqiu wants to calculate the number of ways to forge his longsword. As the result can be very large, you should output the answer modulo 998244353.

Input

The first line contains a single integer n ($2 \le n \le 10^6$) — the length of Xingqiu's longsword.

Output

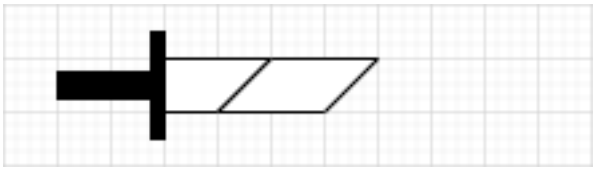
Output a single integer — the number of ways to forge Xingqiu's longsword modulo 998244353.

Examples

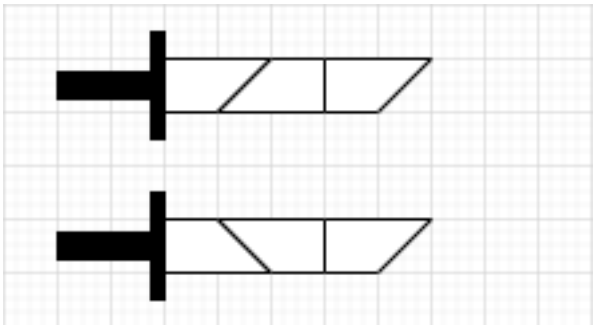
standard input	standard output
2	1
4	1
5	2
7	4
12	25
114514	548004034

Note

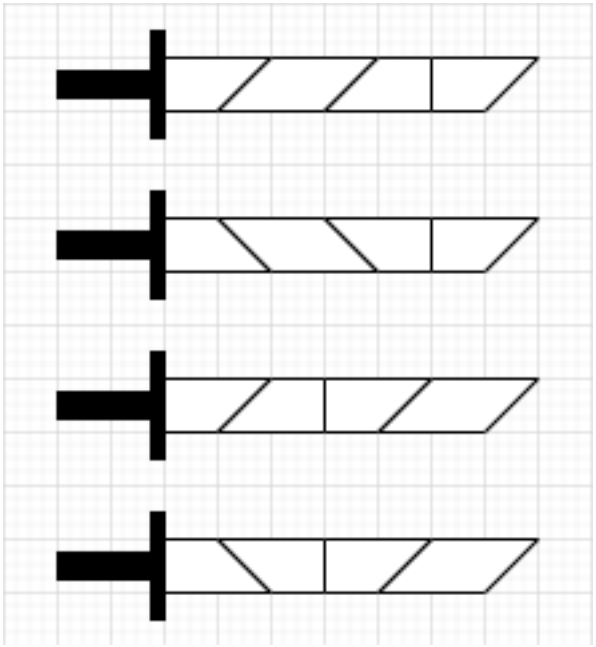
In the first example ($n = 4$), there are 1 way as following:



In the second example ($n = 5$), there are 2 ways as following:



In the third example ($n = 7$), there are 4 ways as following:



As is shown, materials can be rotated and flipped, but can't be cut.

> *An avid reader, Xingqiu's lifelong dream is to be the real-life embodiment of the chivalrous heroes from the pages of his books. For Xingqiu, chivalry is more than a standard of conduct — it's a mindset. The most chivalrous of all are not deterred by setbacks, nor do they stop to indulge their sense of satisfaction when things turn out as hoped. Instead, their minds are focused at all times on seizing the next opportunity to advance the cause of compassion and justice.*

Problem K. ätzlein Cocktail

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	512 megabytes

Diona, Bartender of the Cat's Tail! I charge a hefty fee for private events... huh? You didn't come here for a drink? Hmph... Well, then I accept your invitation... I suppose...

—Diona

Because of her vendetta against alcohol, Diona seeks to mix possibly the most disgusting alcoholic drinks and ruin the Mondstadt wine industry.

Today, Diona still tries to mix disgusting alcoholic drinks. There are n customers in Bartender of the Cat's Tail, and Diona has mixed n different cups of drinks. The i-th customer will like only the i-th cup of drinks and don't like other $n-1$ cups of drinks. Diona deliberately make all drinks the same appearance and randomly place them, because she thinks most customers will get drinks they won't like then.

Actually, after all customers get drinks, each of them will taste and recognize the type of his drink, and then they will exchange their drinks to make sure each of them can get his favorite drink. Exchanging can be tiring, but these customers are clever, they always exchange optimally to minimize the number of exchanging. (For example, if 5 customers get the 2-nd, 4-th, 5-th, 1-st, 3-rd cup of drink respecively, then customer 1 will exchange with customer 4, customer 3 will exchange with customer 5, customer 2 will exchange with customer 4, so each customer gets his favorite drink within 3 exchanges. It can be shown that 3 is the minimum number of exchanges.)

As a result, today, Diona still fails to mix disgusting alcoholic drinks. But gradually Diona gets interested in the optimal way for customers to exchange, she want to calculate the expected value of the minimum number of exchanging in different cases. Specifically, Diona wonder the expected value before no customer get any drink and when everytime a customer get a drink.

It can be shown that the expected value can be represented as a rational number $\frac{P}{Q}$. As P and Q can be very large, you should output $\frac{P}{Q} \bmod 998244353$. Recall that $\frac{P}{Q} = PQ^{-1}$, and Q^{-1} is defined as a number which can satisfy $QQ^{-1} \bmod 998244353 = 1$.

Input

The first line contains a single integer n ($1 \le n \le 5 \times 10^5$) — the number of customers in Bartender of the Cat's Tail today.

The second line contains n integers p_i ($1 \le p_i \le n$), which means the i-th customer get the p_i-th cup of drink, and you need to calculate the expected value of the minimum number of exchanging.

It is guaranteed that all of p_i are distinct, *i.e.* no two or more customers will get the same cup of drink.

Output

Output $n + 1$ integers. The first integer is the expected value of the minimum number of exchanging before no customer get any drink, and the i-th integers in following n integers is the expected value of the minimum number of exchanging after i customers get their drinks.

Examples

standard input	standard output
1 1	0 0
3 2 3 1	166374060 499122178 2 2

Note

In the second example, the output consist of 4 integers, which is explained as following.

- **Before no customer get any drink**: There are 6 possible situations — three customers get the [1-st, 2-nd, 3-rd] or [1-st, 3-rd, 2-nd] or [2-nd, 1-st, 3-rd] or [2-nd, 3-rd, 1-st] or [3-rd, 1-st, 2-nd] or [3-rd, 2-nd, 1-st] cup of drink respectively. It costs $0, 1, 1, 2, 2, 1$ exchanges in these situations respectively, so the expected value of the number of exchange is $\frac{0+1+1+2+2+1}{6} = \frac{7}{6}$, which is 166374060 after modulo.
- **After costumer** 1 **gets the** 2**-nd cup of drink**: There are 2 possible situations — three customers get the [2-nd, 1-st, 3-rd] or [2-nd, 3-rd, 1-st] cup of drink respectively. It costs $1, 2$ exchanges in these situations respectively, so the expected value of the number of exchange is $\frac{1+2}{2} = \frac{3}{2}$, which is 499122178 after modulo.
- **After costumer** 2 **gets the** 3**-rd cup of drink**: There is only one possible situation — three customers get the [2-nd, 3-rd, 1-st] cup of drink respectively. It costs 2 exchanges in this situation, so the expected value of the number of exchange is 2, which is still 2 after modulo.
- **After costomer** 3 **gets the** 1**-st cup of drink**: The last customer just chooses his only choice. There is still only one possible situation and the expected value is still 2.

Despite being a bartender at Cat's Tail, she actually despises alcohol and wants nothing more than to ruin Mondstadt's wine industry—a feat easier said than done when her patrons absolutely love her drinks.

Problem L. et the wind tell you

Input file:	standard input
Output file:	standard output
Time limit:	2 seconds
Memory limit:	512 megabytes

When rain starts pouring suddenly in your blue skies

Know that it's me blowing up dark and gloomy clouds

When a light breeze rustle through your hair

Know that it's me thinking of you from afar

Venti, *Aka.* Barbatos, is a bard that seems to have arrived on some unknown wind — sometimes sings songs as old as the hills, and other times sings poems fresh and new.

Today, Venti is commissioned to beat hilichurls. Hilichurl camp can be represented by an unrooted tree with one hilichurl in each node (Recall that a tree is an acyclic connected graph). As the Anemo Archon, Venti can use his talent to gather the nearby hilichurls easily. Specifically, Venti can choose a node u, then, all hilichurls in nodes directly connected by u will be gathered to node u.

Now, in order to beat hilichurls more conveniently, Venti wants to gather all of them to only one node. Using talent can be tiring, therefore, Venti wants to minimize the number of using talent to gather all hilichurls to only one node. For a given hilichurl camp, Venti want to calculate the number of ways to gather all hilichurls to only one node when the number of using talent is minimized. As the result can be very large, you should output the answer modulo 998244353.

Two ways are considered different if for one or more indexes i, the i-th operation in the first way and the i-th operation in the second way act on different nodes.

Input

The first line contains a single integer n ($2 \le n \le 10^5$) — the size of hilichurl camp.

The i-th line of following $n-1$ line contains two integers u_i, v_i ($1 \le u_i, v_i \le n$, $u_i \ne v_i$), which means there is a road between node u_i and node v_i in hilichurl camp.

It is guaranteed the given input forms a tree.

Output

Output a single integer — the number of ways to gather all hilichurls to only one node when the number of using talent is minimized.

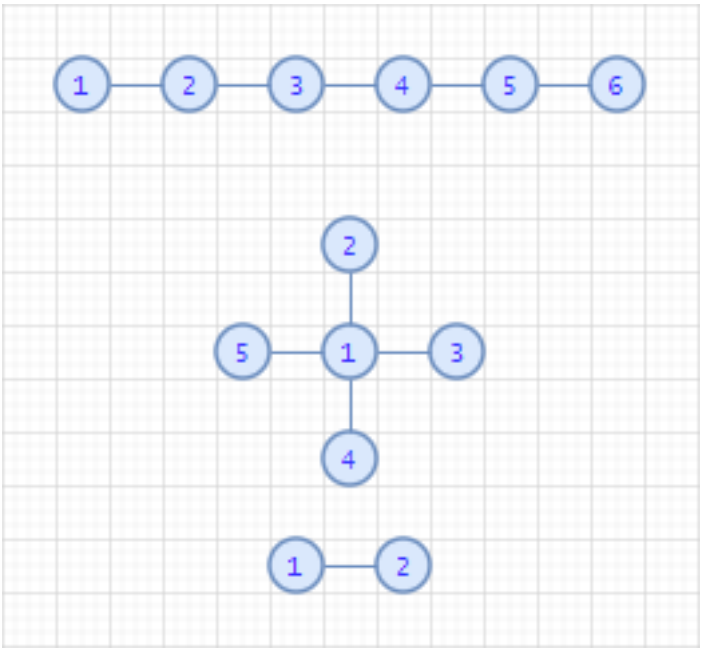
Examples

standard input	standard output
6 1 2 2 3 3 4 4 5 5 6	8
5 1 2 1 3 1 4 1 5	1

standard input	standard output
2 1 2	2
8 1 2 1 3 2 4 2 5 4 6 5 7 3 8	28

Note

The hilichurl camp in the first three examples are as follows:



In the first example, Venti needs to use talent for 4 times, his operation sequence can be any one of the following 8 sequences: $[5,4,3,2]$, $[2,5,4,3]$, $[5,2,4,3]$, $[5,4,2,3]$, $[5,3,2,4]$, $[3,5,2,4]$, $[3,2,5,4]$, $[2,3,4,5]$.

In the second example, Venti needs to use talent for 1 time, he should choose node 1 to use talent, otherwise, he needs to use talent more than 1 time to gather all hilichurls.

In the third example, Venti needs to use talent for 1 time, he can choose any one of two nodes to use his talent.

Recall that **two ways are considered different if for one or more indexes i, the i-th operation in the first way and the i-th operation in the second way act on different nodes.**

If you find yourself clinging onto the past, reluctant to move on

I shall quietly remember these poems in my heart

If you grow tired of gravity and wish to fly

Then I shall let the winds of the world all blow towards you

Problem M. abushii Omoi

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	1024 megabytes

In order to protect your physical and mental health, we strongly recommend you to skip this problem if you are not a experienced programmer! :o

—Writers of this problem

This is the hard version of *Problem A. stral Reflection*. In this version, w can be in $[1, 1e9]$, but we promise any operation of type 2 will be after any operation of type 1.

In event *Unreconciled Stars*, some meteorites fell on Teyvat and confused people's minds. In order to protect the people of Teyvat, Mona needs to clean up these meteorites.

Teyvat can be represented by a line $[1, n]$, and meteorites can be represented by some points in this line. For clearing meteorites, Mona can use some types of her talents. A talent can be represented by three integers l, r, w, which means Mona can spend w Power clearing all meteorites in $[l, r]$ by using this talent. At the beginning, Mona has no talent, but she will learn gradually.

Mona wants to spend as few Power as possible. For each wave of meteorite shower, Mona wants to know if she can clean up all the meteorites by using the talents she has mastered by then, and if yes, what the minimum possible Power it requires to clean all of them. More specifically, there will be two types of operation:

- `1 l r w`: Mona learns a new talent to clear all meteorites in $[l, r]$ with w Power.
- `2 k a_1 a_2 ... a_k`: There are k meteorites in point $a_1, a_2, \ldots, a_k$. Mona needs to calculate the minimum power she needs to spend to clear these k meteorites, or point out that some of meteorites are impossible to clear.

Note: Meteorites from the previous wave will be cleared automatically, no matter if Mona succeeds in clearing all of them or not.

Input

The first line contains two integers n, m ($1 \le n, m \le 10^5$) — the size of Teyvat and the number of operations.

In the following m lines, each line will be in one of the following format as described in the statement:

- `1 l r w` ($1 \le l \le r \le n$, $1 \le w \le 10^9$)
- `2 k a_1 a_2 ... a_k` ($1 \le k \le n$, $1 \le a_1 < a_2 < \cdots < a_k \le n$)

All of input are integers.

It is guaranteed that the sum of k for all operations does not exceed 10^5.

Output

For each operation of type 2, output the minimum power Mona needs to spend to clear these meteorites. If some of meteorites are impossible to clear, output -1.

Example

standard input	standard output
10 10 1 1 10 15 1 2 3 5 1 2 5 6 1 3 7 8 1 5 6 1 1 6 9 3 1 7 10 5 2 4 1 2 4 5 2 4 4 5 6 8 2 5 3 6 7 8 10	15 9 11

Note

In the first example, operations are explained as follows:

- Firstly, Mona learns 7 talents:
  - Spend 15 Power clearing up all meteorites in $[1, 10]$
  - Spend 5 Power clearing up all meteorites in $[2, 3]$
  - Spend 6 Power clearing up all meteorites in $[2, 5]$
  - Spend 8 Power clearing up all meteorites in $[3, 7]$
  - Spend 1 Power clearing up all meteorites in $[5, 6]$
  - Spend 3 Power clearing up all meteorites in $[6, 9]$
  - Spend 5 Power clearing up all meteorites in $[7, 10]$
- Secondly, Mona needs to clean up 3 waves of meteorites:
  - In the first wave, there are meteorites in point $1, 2, 4, 5$. Mona spends 15 Power clearing up all meteorites in $[1, 10]$.
  - In the second wave, there are meteorites in point $4, 5, 6, 8$. Mona spends 6 Power clearing up all meteorites in $[2, 5]$, then spends 3 Power clearing up all meteorites in $[6, 9]$. She spends $6 + 3 = 9$ Power totally.
  - In the third wave, there are meteorites in point $3, 5, 6, 7, 10$. Mona spends 5 Power clearing up all meteorites in $[2, 3]$, then spends 1 Power clearing up all meteorites in $[5, 6]$, then spends 5 Power clearing up all meteorites in $[7, 10]$. She spends $5 + 1 + 5 = 11$ Power totally.

Problem N. anikore

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

Could you please write some problems that everyone can pass?

— A certain organizer of HEUCPC2021

The 16th Harbin Engineering University Collegiate Programming Contest will be held in April 25, 2021.

If 2021 is a prime, output `Yes`; otherwise, output `No`.

You can print each letter in any case (upper or lower). For example, `nO` will be also considered a correct answer if `No` is a correct answer.

Recall that a prime is a natural number greater than 1 that is not a product of two smaller natural numbers. For example, 5 is prime because the only ways of writing it as a product, 1×5 or 5×1, involve 5 itself. However, 4 is not prime because it is a product 2×2 in which both numbers are smaller than 4.

Input

No input.

Output

Output `Yes` or `No`.

You can print each letter in any case (upper or lower). For example, `nO` will be also considered a correct answer if `No` is a correct answer.

Example

standard input	standard output
(no input)	

Note

In order to make sure there is no any tip, we don't provide example output. Sorry for any inconvinience.

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