DIU Take-OFF Programming Contest Fall-24 [Final]

https://toph.co/c/diu-take-off-fall-24-final

Toph

Schedule

The contest will run for **4h0m0s**.

Authors

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Rules

This contest is formatted as per the official rules of ICPC Regional Programming Contests.

You can use C++17 GCC 13.2, C++20 GCC 13.2, C++23 GCC 13.2, C11 GCC 13.2, C17 GCC 13.2, and C23 GCC 13.2 in this contest.

Be fair, be honest. Plagiarism will result in disqualification. Judges' decisions will be final.

Notes

There are 12 challenges in this contest.

Please make sure this booklet contains all of the pages.

If you find any discrepencies between the printed copy and the problem statements in Toph Arena, please rely on the later.

A. Neville's Magical Labeling

Neville Longbottom, the lovable clumsy guy of Hogwarts, had always been a bit of a walking disaster. While his classmates breezed through their magical education, Neville often found himself tripping over his own feet—sometimes literally. From losing his toad, Trevor, to being the favorite target of Professor Snape's scorn, Neville's life was a series of unfortunate events.

The final straw came during the end-of-year assignments. Professor McGonagall, in her infinite wisdom, handed out tasks to the students. Hermione got to brew a rare potion (because of course it's Hermione). Harry and Ron were paired up for an epic Defense Against the Dark Arts duel. Even Luna Lovegood was off discovering new magical creatures.

And Neville? Well, Neville was given the most thrilling task of all: writing labels for every potion bottle in the greenhouse. Riveting stuff.

"Why is it always me?" Neville grumbled, staring at the endless rows of bottles. "Just because I'm not as skilled as everyone else, I always get stuck with the same boring, repetitive tasks!"

Determined to make the best of it, Neville decided to add a bit of flair to his task. Using a charm he had recently learned in Professor Flitwick's class, he enchanted the labels with a unique numerical signature. The spell calculated the sum of the alphabetical positions of the letters in his name—N was 14, E was 5, and so on. Though the bottles would all bear the same name, they now carried a touch of Neville's own quirky magic.

As the rows of bottles slowly filled up with their enchanted labels, Neville felt a small flicker of satisfaction. Maybe the task wasn't so thrilling, but he had made it his own.

Now, Neville wonders: what is the total numerical value of his name? Can you help him calculate it?

Input

There is no input for this problem.

Output

Print the total value of the name "Neville Longbottom", calculated as the sum of the alphabetical positions of its letters.

Example: A = 1, B = 2,..., Z = 26. Ignore spaces. Both uppercase and lowercase letters have the same value (e.g., 'A' = 'a' = 1).

Be careful about the newline('\n') at the end.

B. The Enchanted Staircase

At Hogwarts, the enchanted staircases moved unpredictably, but one particular staircase had a unique secret. Hidden in its magical carvings was a powerful charm: a puzzle that could unlock a treasure chest in the Room of Requirement.

Harry, Hermione, and Ron were exploring the castle when they stumbled upon an old map in the library. It led them to this staircase, where a riddle inscribed on the wall read:

"To find the key and reach your prize,
Summon the sums, where sequences rise.
Start with S and end with E,
Solve this riddle, and you'll see."

Beneath the riddle, the rules of the enchantment glimmered into view:

- S is the starting number of an arithmetic sequence.
- E is the ending number.
- Find the sum of all sequences starting at S and ending at E, modulo $10^9 + 7$.

To help Harry and Ron understand, Hermione gave an example:
"If $S = 1$ and $E = 5$, the possible sequences are:
$1, 2, 3, 4, 5$
$1, 3, 5$
$1, 5$

We need the sum of all the numbers in these sequences, modulo $10^9 + 7$."

Harry scratched his head. "So we're adding all the numbers in every possible sequence?"

"Exactly," said Hermione. "It's the key to the treasure."

Input

The first line contains a single integer $T (1 \leq T \leq 10^4)$— the number of test cases.

The following T lines each contain two integers S and E $(1 \leq S, E \leq 10^6$)— the starting and ending numbers of the arithmetic sequences.

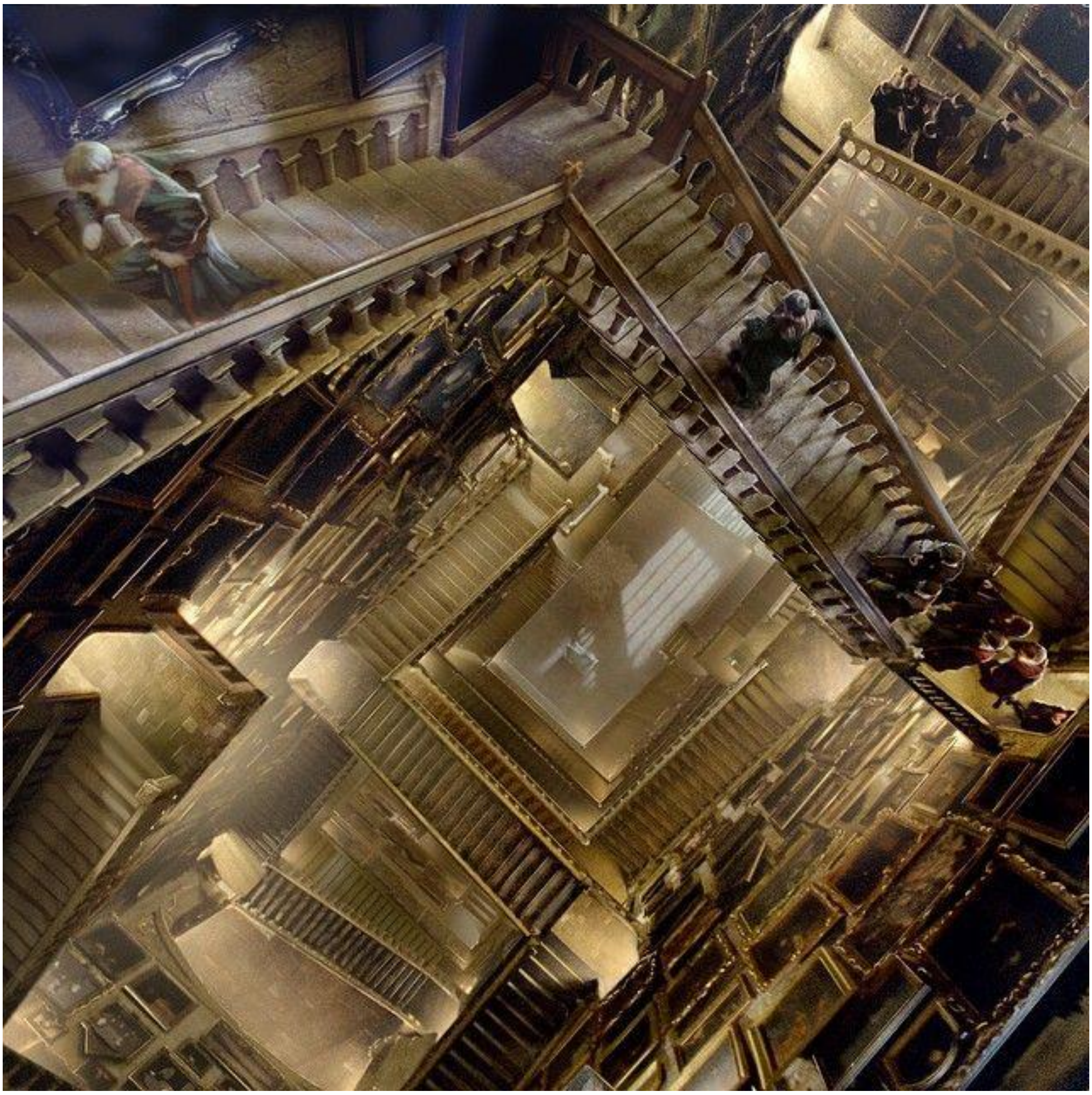
Output

For each test case, output a single integer — the sum of all numbers in all possible arithmetic progressions starting at S and ending at E, modulo $10^9 + 7$.

Samples

Input	Output
1 1 5	30

If you're wondering how charmful the staircase looked —



C. Harry, The Chill Guy

Harry woke up feeling a bit weak. His scar wasn't throbbing, but something about the day felt off. Maybe it was the dark clouds outside that looked suspiciously like dementors, or the fact that Ron had managed to spill pumpkin juice all over his essay.

Harry eyed the golden vial of Felix Felicis, the "Liquid Luck" he had won for making the best potion in Professor Slughorn's class. "Maybe today it will help me out," he whispered, feeling a tiny thrill of hope.

But Harry remembered Professor Slughorn's warnings: "Each drop has random chill points. You need enough to feel lucky. And no more than three drops a day, or it backfires!"

Harry took a deep breath and let three drops fall on his tongue one by one. It warmed him, and he felt calm, but he wasn't sure if he had gained enough chill points to make his day great or not. He needed at least X chill points to feel truly relaxed. But if he does not have that much but gained at least Y points then there is a possibility of the day to be good. The first drop of "Liquid Luck" gave him A chill points, the second gave him B chill points, and the third gave him C chill points.

So, your task is to determine if he had enough chill points or if today will still turn out to be a bad day for Harry. After all, I'm just a chill guy trying to help out!

Input

The input consists of two lines. The first line contains two integer numbers X and Y, denoting the minimum point for true relaxation and minimum points so that he can hope.

The second line contains three integer numbers A, B, and C representing the chill points of the first, second, and third drop of liquid luck consecutively.

$1 \leq Y < X \leq 10^6$

$0 \leq A, B, C \leq 10^5$

Output

Print "Chill guy" if he got enough chill points for today, or "Who knows" or if he is not certain, and "A bad day" otherwise without quotation marks.

Samples

Input	Output
10 7 5 6 4	Chill guy

Input	Output
10 7 1 2 3	A bad day

Be careful about the newline('\n') at the end.

D. Journey from Platform 9¾

The Hogwarts Express begins its legendary journey from Platform $9\frac{3}{4}$, a hidden magical platform at King's Cross Station in London. This platform is an iconic part of the Harry Potter universe, as it serves as the gateway for young witches and wizards to travel to Hogwarts School of Witchcraft and Wizardry. To access it, passengers must run directly at the seemingly solid barrier between platforms 9 and 10.

The train travels the first half of the distance at a speed of x km/sec, reaching the halfway point at exactly t seconds. At this point, the train magically changes its speed to y km/sec and continues for the second half of the journey.

Your task is to calculate the total travel time in seconds for the Hogwarts Express. if it takes more than 2676275 seconds print “Forever” without quotes.

Input

The input contains there integer x, t, y

- $x \ (1 \leq x \leq 1000)$ is the train's speed before halfway (in km/sec).
- $t \ (1 \leq t \leq 3600)$ is the time (in seconds) it takes to reach halfway.
- $y \ (0 \leq y \leq 1000)$ is the train's speed after halfway (in km/sec).

Output

Output the total travel time to Hogwarts in seconds. (use floor value if you get floating-point number)

Samples

Input	Output
`80 10 29`	`37`

Input	Output
`10000 3600 12`	`Forever`

E. The Vault of Forgotten Treasures

Late one stormy night, Harry, Ron, and Hermione were called to the Headmaster's office. To their surprise, it wasn't McGonagall who awaited them, it was a shimmering projection of Albus Dumbledore himself.

"Ah, my brave trio," the projection began. "I have left behind a hidden vault containing relics that hold immense power. These treasures must not fall into the wrong hands. To unlock the vault, you must solve the riddle left by the goblins who guarded it. But beware, failure means the vault will seal forever."

The riddle was a mathematical puzzle embedded in the very magic of the vault. The numbers etched on the goblin's scroll were a clue. Harry sighed, "Why is it always us?" Hermione, of course, was already scribbling on a piece of parchment.

The vault contains a list of magical resonance levels (numbers) and a target magical resonance K. To open the vault, the trio must find all valid pairs of resonance levels (a, b) that meet the following criteria:

1. Perfect Match: The product of the two resonance levels must equal the target $K : a \times b = K$.
2. Weaker to Stronger: The first relic's resonance level a must be less than or equal to the second relic's $b : a \leq b$

Griphook''s voice trembled with urgency. "Time is running out, and dark forces are closing in. Harry, Hermione, and Ron are counting on you to find all the valid pairs and break the enchantment! Can you unlock the vault and secure the magical treasures before it's too late?"

Input

1. The first line contains two integers N and K:
   - N: The number of resonance levels $(2 \leq N \leq 10^3)$.
   - K: The target resonance $(1 \leq K \leq 10^6)$.
2. The second line contains N integers in sorted order, where $(a_i \leq a_{i+1},\ \ 1 \leq a_i \leq 10^6)$, representing the resonance levels.

Output

Print a single integer—the number of valid pairs (a, b).

Samples

Input	Output
`5 6` `1 2 3 6 10`	`2`

There are two valid pairs:

- $(1, 6)$ because $1 \times 6 = 6$.
- $(2, 3)$ because $2 \times 3 = 6$.

Hermione shouts, “That’s it!” The vault begins to glow faintly as the first layer of magic is undone.

Input	Output
`3 12` `4 5 6`	`0`

No valid pairs satisfy $a \times b = 12$.

The vault remains locked tight. Hermione frowns, “We must be missing something.”

Be careful about the newline (‘\n’) at the end.

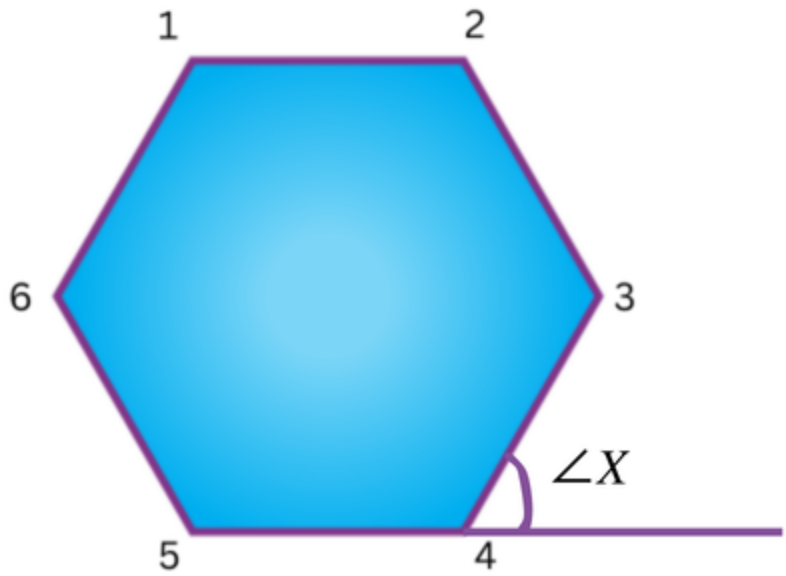
Also, if you’re bored from thinking too much, here’s a comic for you —


WELCOME BACK, HARRY, WE HAVE MISSED YOU HERE AT HOGWARTS.
THANKS DUMBLEDORE. YOU KNOW, THERE WAS SOMETHING I WAS WONDERING.
WHAT IS IT?
WELL, DURING MY REGULAR MUGGLE EDUCATION I'VE BEEN READING A LOT OF MORAL AND POLITICAL PHILOSOPHY.
SO I WAS SORT OF WONDERING, WHAT IS THE PHILOSOPHICAL JUSTIFICATION FOR KEEPING MAGIC A SECRET?
MAGIC CAN CURE DISEASES, FEED THE HUNGRY, AND EMPOWER THE OPPRESSED TO UP RISE AGAINST THEIR OPPRESSORS.
SOME PHILOSOPHERS THINK WE SHOULD MAXIMIZE GLOBAL HAPPINESS, OTHER SAY WE SHOULD BASE OUR SOCIETY ON UNIVERSAL JUSTICE. WHAT PRINCIPLE DOES HOGWARTS OPERATE ON?
YOU SEE, HARRY, WE HERE AT HOGWARTS BELIEVE ABOVE ALL ELSE IN UPHOLDING OUR OWN POWER AND PRIVILEGE, EVEN IF ALL THE MUGGLES IN THE WORLD HAVE TO SUFFER.
BASED ON WHAT PHILOSOPHICAL GROUNDING? HOW DO YOU JUSTIFY IT?
HOW DO WE JUSTIFY IT? I THOUGHT THAT WAS OBVIOUS.
HARRY, WE ARE ENGLISH.

F. The Polygon of Perplexity

The wizarding world is in trouble! Mysterious magical portals are appearing everywhere, connecting key locations like Diagon Alley, the Forbidden Forest, and even the Chamber of Secrets. The Department of Mysteries has traced these portals to an ancient enchanted N-sided regular polygon created by none other than the infamous dark wizard Grindelwald during his rise to power.

To stop Grindelwald's evil plan, Harry has discovered the secret: the exterior angle of the polygon holds the key to unraveling the spell! But Harry couldn’t find the value of the angle. So, You need to help him to find the angle.



Note: Here, the $\angle X$ denotes the exterior angle of a regular polygon.

Input

An integer N: the number of sides in the polygon.

Constraints:

$3 \leq N \leq 10^6$

Output

Print one real number — the value of the exterior angle of the polygon (in degrees). The absolute or relative error should not exceed 10^{-6}.

Samples

Input	Output
6	60.000000

G. Layers of the Wizarding World

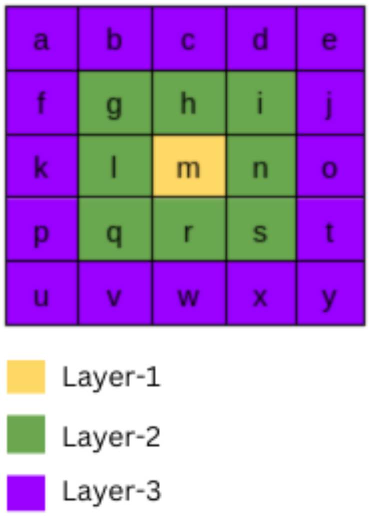
Hogwarts School of Witchcraft and Wizardry, the most renowned magical institution, is bustling with activity as the Triwizard Tournament draws near. The school grounds are divided into magical zones, forming concentric layers around the Great Hall. Each magical zone hosts wizards and witches participating in various events, with their presence marked by the initial letter of their names in a grid representation of Hogwarts.

You are tasked with analyzing the distribution of participants based on their initials within these zones. Each zone corresponds to a layer in the grid, starting with the innermost layer at the center of Hogwarts and expanding outward. Your job is to determine how many participants in a specified layer have names starting with a given letter.

Grid layers can be defined as below —

1. Layer 1: The innermost square at the center of the grid.
    - If n (the grid size) is odd, this layer is the single central cell.
    - If n is even, this layer is a 2×2 square.
2. Layer 2: The border surrounding Layer 1.
3. Layer 3: The border surrounding Layer 2, and so on.
4. The pattern continues until the outermost layer, which forms the boundary of Hogwarts.

The total number of layers is $\lceil n/2 \rceil$. Here is an better understanding of ther layers —



Input

The first line contains an integer n $(1 \le n \le 100)$, the size of the grid.

The next n lines each contain a string of n lowercase English letters, representing the grid of participants.

The following line contains an integer q $(1 \le q \le 100)$, the number of queries.

Each of the next q lines contains two values:

- L: An integer $(1 \le L \le \lceil n/2 \rceil)$, the layer number.
- C: A lowercase English letter ('a' to 'z') representing the initial of a wizard or witch's name.

Output

For each query, output a single integer on a new line — the number of participants in the L-th layer whose names start with the letter C.

Samples

Input	Output
5 abcde fghij klmno pqrst uvwxy 3 1 m	1 1 1

Input	Output
2 g 3 a	

H. Chocolate Frogs

If you've ever heard of Chocolate Frogs, you know they're not just any ordinary chocolate. They're delicious, yes, but also enchanted to jump around, making them as fun as they are tasty! Harry learned this the hard way when he let his first Chocolate Frog leap right out of the window of the Hogwarts Express.

Today, during a much-needed study break in the Gryffindor common room, Harry, Ron, and Hermione have turned these mischievous treats into the centerpiece of a new game. Here's how it works:

Ron & Hermione gather N boxes numbered 1 to N and while Harry look away, they put the frog in one of the boxes. Then Ron starts swapping pairs of boxes. After each swap, Harry must guess which box hides the elusive Chocolate Frog. This goes on for Q rounds and Hermione, knowing the actual position of the frog, tracks Harry's score if Harry can guess correctly. Afterwards, she tells Harry his score.

Despite not knowing the initial position of the frog, Harry is determined to guess as cleverly as possible after every swap to maximize his score.

Your task is to help Harry determine the maximum possible score he could have achieved, assuming he guessed optimally for all possible initial placements of the Chocolate Frog.

Input

In the first line of input, you are given N, the number of boxes and Q, the number of swaps. Then Q lines follow. Each line contains three integers a, b and c, indicating that box a and b gets swapped by Ron and after that Harry claims box c contains the frog.

$1 \leq N \leq 10^3$

$1 \leq Q \leq 10^5$

$1 \leq a, b, c \leq N$

Samples

Input	Output
3 4 1 2 1 1 3 1 2 3 1 3 2 1	3

If the frog started in box 1, then after first, second, third and fourth swap it would be in 2nd, 2nd, 3rd and 2nd box respectfully, which means Harry would have gotten no points as he guessed 1st, 1st, 1st and 1st. If it started in box 2, then it would be in 1st, 3rd, 2nd and 3rd box, which would give Harry a score of 1 as his first guess was correct. If started under box 3, then it would be in 3rd, 1st, 1st and 1st box, which would mean Harry gets a score of 3. This is the maximum possible score.

Input	Output
4 5 4 3 2 4 2 4 3 1 2 2 3 4 3 4 4	3

Note that a and b can be equal, that will just mean that Ron actually did not perform any swaps.

I. Muggle Math

Hermione, while going through math books in Hogwarts Central Library, found a very interesting 4-digits number — 6174. This number was discovered by a muggle mathematician D.R. Kaprekar. What's interesting about this number is, if you sort the digits of the number in descending order — 7641 and substract from it the number you get by sorting the digits in ascending order — 1467, you will get 6174 back! Hermione wanted to play with several more 4-digits numbers. She proceeds as following.

She selects a 4-digits number N, and take another number K. Then she does the operation mentioned above K times on it, which is —

- Get a new four digits number A by sorting the digits in descending order.
- Get a new four digits number B by sorting the digits in ascending order.
- Get the final number by doing $A - B$.

Then for next operation, she uses this final number as N.

For example, one operation on 3427 will give us $7432 - 2347 = 5085$. The next operation will give us $8550 - 0558 = 7992$. And so on. Please keep in mind that she will add zeros to the front of the final number to make it 4-digits, if it has less than 4 digits.

But since she's got little time at hand, she asks for your help. You need to find the number you will get after doing the operation K times on the number N.

Input

The only line of the input contains two number N and K, where N is the initial 4-digits number and K is the number of times she wants to perform the operation.

$1000 \le N \le 9999$

$1 \le K \le 10^9$

Output

Output the final number after performing the operation K times.

Samples

Input	Output
3427 2	7992
This case is described in the statement.	

Input	Output
6174 1000000000	6174
As per Hermione's findings, no matter how many times you do operation on this number, it will stay the same.	

Anyway, here's a not so rare picture of Hermione getting herself busy in studying —

J. Prime Pair Hunt

The wizarding world is in turmoil. Lord Voldemort has hidden a part of his soul in an unusual and clever horcrux, one that cannot be destroyed by conventional means. This horcrux is protected by ancient prime number magic, devised to outwit even the smartest of wizards. The task to destroy this horcrux falls upon Harry Potter, Hermione Granger, and Ron Weasley, who must solve the puzzle to retrieve and destroy it.

Dumbledore, before his passing, discovered that the horcrux lies within the magical realm of numbers, where two prime numbers, a and b, hold the key. Voldemort has placed the following enchantment:

- The two numbers a and b must both be prime numbers.
- These numbers are within a given range $[l, r]$ (inclusive).
- a must be smaller than b $(l \le a < b \le r)$.
- The difference between b and a, i.e., $b - a$, must also be a prime number.

The trio needs your help to solve this challenge. Determine all valid pairs (a, b) that satisfy Voldemort's conditions. Each valid pair represents a crack in the enchantment protecting the horcrux. Once all pairs are determined, the horcrux can be destroyed!

Input

Two integers, l and r, where $1 \le l \le r \le 10^7$

Output

A single integer representing the count of all such pairs (a, b) that satisfy the given conditions.

Samples

Input	Output
11 98	6

K. A Magical Quest

In the magical world of Hogwarts, the legendary phoenix Fawkes holds a special place as the faithful companion of Professor Albus Dumbledore. Known for his immortality, Fawkes is reborn from his ashes after each death, symbolizing resilience and renewal. However, the exact **revival day** of Fawkes remains a mystery, hidden from all but a select few.

Dumbledore, in his wisdom, devised a **circular array of spells** to guard this secret. This array, much like Fawkes' eternal cycle, loops back to the beginning after its end, forming an unbroken magical circle. The spells within this array are unique and carefully arranged to hold the secret of Fawkes' next revival day, ensuring that only those worthy of solving the puzzle can uncover it.

Now, as an aspiring wizard or witch, you are tasked with deciphering this magical array to locate the **revival spell** as efficiently as possible. Starting always from the first spell, you must determine the **minimum steps** needed to find the correct spell, using the ability to traverse the array in both **clockwise** and **counterclockwise** directions. "How would I know which one is the correct spell", you ask? **The correct spell is the largest spell in that circular array.**

Your mission is to prove your worth by uncovering the day of Fawkes' rebirth, that is, count the minimum steps to find the correct spell, carrying forward Dumbledore's legacy of wisdom and magic.

Input

The first line of the input contains integer n ($1 \leq n \leq 10^6$). The second line contains n space-separated distinct integers ($1 \leq |a_i| \leq 10^9$) — the array elements.

Output

Print a single integer — the minimum steps you need to find the revival spell.

Samples

Input	Output
5 4 2 1 5 3	2
Here the revival spell is 5 which can be found in a minimum move if we go anti-clockwise.	

L. Find the Needle in the Haystack!

(The setter is tired and sleepless so this statement would be short)

“Turn to page 394”, Professor Snape said in a monotonic voice. Hermione, being the know-it-all student, turned the page first with a smirk on her face. She was confident in her studies but the problem that she saw in that page was totally new to her. She didn’t know what to do. So, she asked her trusted friends Ron and Harry but neither of them could say the answer. The problem is given below:

Given a string s and multiple queries, each with a range (l, r) where you need to check if all characters in the substring $s[l...r]$ (inclusive) are unique.

Can you solve this problem?

- $1 \leq |s| \leq 10^3$
- $1 \leq l \leq r \leq |s|$
- $1 \leq q \leq 10^5$

Input

A string $s(1 \leq |s| \leq 10^5)$, consisting of lowercase alphabets $(a - z)$.

An integer q representing the number of queries.

q lines follow, each containing two integers l and $r(1 \leq l \leq r \leq |s|)$.

Output

For each query, print "YES" if the substring $s[l...r]$ contains only unique characters, otherwise print "NO".

Samples

Input	Output
abbcbcwb 1 5 7	YES