2020 Luogu Multi-University Spring Training Contest Day 1

fstqwq

2020.2.29

Problem author fstqwq, Winniechen

Tester Tommyr7, desprado2

Problem A À la Volonté du Peuple

Problem B Billionaire

Problem C Counting K-ary Palindromes

Problem D Deceiver

Problem E Everybody deserves a long long name

Problem F Final Spark

Problem G Goldbach's conjecture

Problem H Hazardous

You may enable O2 optimization when submitting solutions.

Problem A. À la Volonté du Peuple

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

Will you give all you can give
So that our banner may advance?
Some will fall and some will live
Will you stand up and take your chance?
The blood of the martyrs
Will water the meadows of France!

A solitary spark can start a prairie fire.

You are given a weighted connected undirected graph with n vertices and m edges. You know that someone light up a fire at vertex 1, which will burn the current position into dust immediately and expand to adjacent places at the speed 1 mile per second. The fire will split at the vertices to all those edges who have not been lighten up, and will cause a blast when at least two fires meet at the same point.

Revolutionaries love explosions. They want you to count the number of explosions that will happen on the graph.

La Liberté guidant le peuple, from Wikimedia Commons

Input

The first line contains integers n, m ($1 \le n \le 3 \times 10^5$, $0 \le m \le 10^6$) - the number of vertices.

Each of the next m lines contains 3 integers $u_i, v_i, w_i (1 \le u_i, v_i \le n, 1 \le w_i \le 9)$ - the ends of the i-th edge and the weight of the i-th edge.

It's guaranteed that the graph is connected.

The graph may contain self loops and multiple edges. Example 1 shows the method to deal with them.

The size of input file may be large. Please, do not read input by too slow ways.

Output

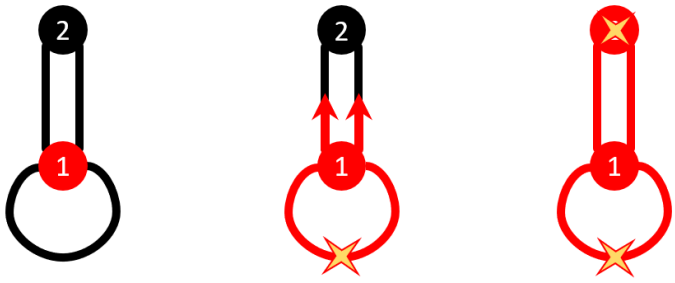
Output the number of explosions that will happen on the graph in a single line.

Examples

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

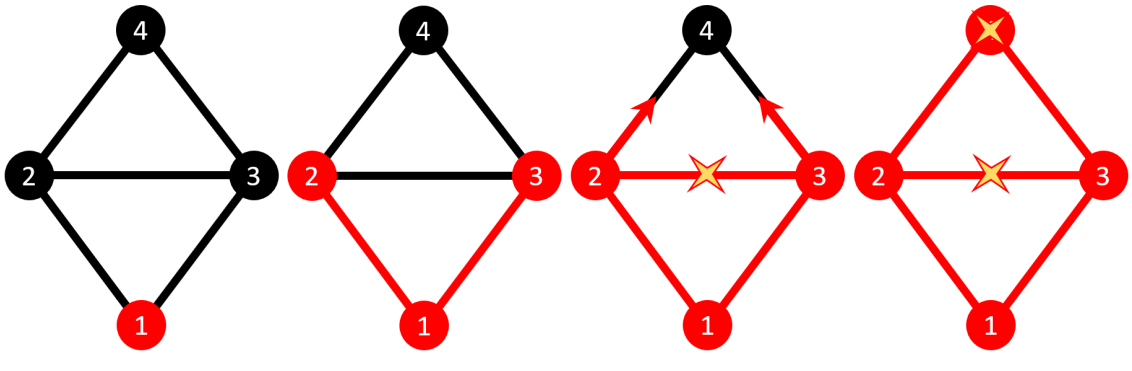
Notes

Here's the illustration for example 1:



$T = 0s$ $T = 0.5s$ $T = 1s$

Here's the illustration for example 2:



$T = 0s$ $T = 1s$ $T = 1.5s$ $T = 2s$

Problem B. Billionaire

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

"Today is a good day", Winnie shouted gaily.

The reason why Winnie is cheerful is that she met Aladdin's lamp today, which gave her a chance to realize a dream. When Winnie was a little kid, she always wanted to be a billionaire. So she said to the lamp:

"I WANT TO BE RIIIIIIIIIIIIIIICH!"

"Alright, but it's not a good deal if I gave a large amount of money immediately. So, I will give you 0 dollar today, but I will increase the amount of money by 1 every day. That is to say, I will give you 1 dollar tomorrow, 2 dollars the day after tomorrow..."

"However, only smart ones can be rich, so you should answer me immediately when you will become a billionaire."

It's no hard for Winnie because she is good at calculating. Currently she has M dollers in her bank account, and she told the lamp precisely the date she will become a billionaire if she would not use the money in that account.

Now you, too, is a smart guy. So you will know the answer for the question: given M and today's date, what is the date she becomes a billionaire?

Input

The first line contains an integer $T(1 \leq T \leq 10^5)$ - the number of test cases.

Each test case description contains the only line contains four integers, M, y, m, d ($0 \leq M < 10^9$, $1900 \leq y \leq 2050$, $1 \leq m \leq 12, 1 \leq d \leq 31$) - the money she currently has, and the year, month, day of now.

It is guaranteed that y, m, d forms a corrent date.

Output

For each test case, print three integers denoting the answer date on a seperate line.

Please, do not print the leading zero of the month and day. See sample output for clarity.

Examples

stdin	stdout
2 999999999 2020 2 29 114514 1919 8 10	2020 3 1 2042 1 15

Notes

In the first case of the example, Winnie is very rich so that she only takes one day to become a billionaire.

Problem C. Counting K-ary Palindromes

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

A k-ary number is a number with base k represented as $(a)_k$. For example, $(15)_{10} = (\mathrm{f})_{16} = (17)_8 = (1111)_2$. The digits greater than 9 are represented with lowercase English letter $\mathrm{a} \cdots \mathrm{f}$ for $10 < k \leq 16$.

A palindrome number is a non-negative number without extra leading zeros under some determined base k, that reads the same forward or backward. For example, $(121)_{10}, (\mathrm{abba})_{16}, (0)_2$ are palindrome numbers, but $(00)_2, (010)_{10}$ are not.

Today Tommy is too sad to count his favorite k-ary palindrome numbers whose lengths are n and divisible by a prime number p. Can you help him to count how many numbers are Tommy's favorite?

Note that the answer could be very large, all you need to tell is the answer module 998244353 - another Tommy's favorite prime number.

Input

The input contains 3 integers n, p and k ($1 \leq n \leq 10^{18}, 2 \leq p \leq 1000, 2 \leq k \leq 16$) - the palindrome's length, the prime number, and the base.

It is guaranteed that p is a prime.

Output

Output the answer module 998244353.

Examples

stdin	stdout
1 2 10	5
2 7 16	2
16 7 10	12866400
16 7 16	575218836

Notes

In example 1, $(0)_{10}, (2)_{10}, (4)_{10}, (6)_{10}, (8)_{10}$ are valid numbers.

In example 2, $(77)_{16}, (\mathrm{ee})_{16}$ are valid numbers. Note that $(00)_{16}$ is not a desired number because there's an extra leading zero.

Problem D. Deceiver

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

The Double Land is a place that everything come in twins, no except for their coins. They use two types of coins that their values equals to A and B grams of gold. The people there knows Euclid's algorithm very well, so it's promised that the greatest common divisor of A and B is 1. They will show you why the coin system is efficient: by solving the linear indeterminate equation $Ax + By = C$, there will always be a result for every possible integer C.

But things become more complex when it comes into the reality. In fact, changing - in other word, negative x or y - is troublesome, and people on Double Land don't like it at all. So they always pay a little more when there's a must of changing.

A deceiver called Einniw who lives in the Single Land hates the people in the Double Land. Knowing such fact that people will pay more when no suitable non-negative x, y for the price C, he decided to cheat money using such inconvenient prices. He bought a lot of goods, delivering them to the Double Land, and pricing them with various prices - of course, all those prices are inconvenient for people in Double Land.

But Einniw is not very smart - maybe it's the reason he has to live in Single Land till now. He found it hard to calculate the K-th smallest inconvinient price. Can you help him? He is willing to share the money he cheat from people of the Double Land with you!

Input

The first line contains an integer $T(1 \le T \le 10)$ - the number of test cases.

Each test case description contains the only line with three integers, $A, B, K(1 \le A, B \le 10^7$, $1 \le K \le 10^{18})$ - the values of two types of coins, and the required K.

It is guaranteed that $\gcd(A, B) = 1$, and the the K-th smallest inconvinient price exists.

Output

For each test case, print a single integer denoting the K-th smallest inconvinient price on a separate line.

Examples

stdin	stdout
2 2 3 1 314159 233333 123465789	1 123570404

Problem E. Everybody deserves a long long name

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

In the Kingdom of Bears, the King Tommmmmmmmmmmmmmmmy has a very strange hobby: he dislike all names with length less than 10! In fact every time he see who has a short name, he'd be so angry that he refuse to speak in the next 998244353 days!

But Tommmmmmmmmmmmmmmmy the King is essential for the Kingdom of Bears, so the Minister of civil affair, Pneumonoultramicroscopicsilicovolcanoconiosis, announces that: every bear should have a long long name! Renaming is hard for bears, so Pneumonoultramicroscopicsilicovolcanoconiosis uses a sequence of methods to show the rules of renaming as follow:

```
If first letter of the name is not 'g', reverse the name, else append 'h' after the name.
If last letter of the name is not 'y' and first letter of the name is 'w', append 'j' after the name, else append 't' after the name.
If length of the name is not greater than 42, append 'u' after the name, else do nothing.
If last letter of the name is not 'v', reverse the name, else append 'd' after the name.
If length of the name is not greater than 43, append 'o' after the name, else append 'q' after the name.
If first letter of the name is not 'm', reverse the name, else reverse the name.
If last letter of the name is 'x', do nothing, else append 's' after the name.
If length of the name is less than 22, append 'n' after the name, else append 't' after the name.
If first letter of the name is not 'i', do nothing, else reverse the name.
If last letter of the name is 'c', append 'e' after the name, else append 'a' after the name.
If length of the name is not 42 and last letter of the name is 'v', append 'u' after the name, else do nothing.
If length of the name is not less than 47, append 'j' after the name, else reverse the name.
If first letter of the name is not 'v', append 'e' after the name, else append 'd' after the name.
If last letter of the name is 'y', append 'w' after the name, else reverse the name.
If first letter of the name is 'u', reverse the name, else append 'i' after the name.
If length of the name is not less than 32, append 'w' after the name, else do nothing.
If last letter of the name is not 'i' and first letter of the name is 'd', append 'a' after the name, else reverse the name.
If last letter of the name is not 'y', reverse the name, else do nothing.
If first letter of the name is 'y', append 'v' after the name, else reverse the name.
If length of the name is greater than 50, do nothing, else append 'm' after the name.
If last letter of the name is 't', append 'w' after the name, else append 'q' after the name.
If first letter of the name is 't', append 'e' after the name, else do nothing.
If length of the name is greater than 48, append 'l' after the name, else reverse the name.
If last letter of the name is 'y', append 'w' after the name, else reverse the name.
If length of the name is not less than 18 and first letter of the name is not 'b', reverse the name, else append 'c' after the name.
If length of the name is greater than 18, append 'y' after the name, else do nothing.
If last letter of the name is not 'g', append 'a' after the name, else reverse the name.
If first letter of the name is 'q', do nothing, else append 'i' after the name.
If last letter of the name is 'n' and length of the name is not less than 38, append 'o' after the name, else append 'v' after the name.
If first letter of the name is not 'n', do nothing, else append 'z' after the name.
If length of the name is 21 and first letter of the name is not 'm', append 'u' after the name, else append 'o' after the name.
If length of the name is 34, do nothing, else append 'z' after the name.
If first letter of the name is not 'r', reverse the name, else reverse the name.
If length of the name is greater than 25, append 'c' after the name, else reverse the name.
If first letter of the name is not 'u', append 'k' after the name, else append 'l' after the name.
```

```
If length of the name is less than 41, reverse the name, else append 'p' after the name.
If first letter of the name is not 'p', reverse the name, else append 'z' after the name.
If length of the name is less than 4 and last letter of the name is 'p', reverse the name, else append 'l' after the name.
If length of the name is not 16 and first letter of the name is 'w', append 'r' after the name, else append 'o' after the name.
If last letter of the name is 'c', append 'p' after the name, else append 'i' after the name.
If length of the name is not 20, append 'p' after the name, else reverse the name.
If last letter of the name is not 'b', reverse the name, else append 'p' after the name.
If first letter of the name is not 'c', append 'n' after the name, else append 'l' after the name.
If length of the name is not greater than 40, append 'd' after the name, else do nothing.
If first letter of the name is 'g', append 'y' after the name, else append 'i' after the name.
If last letter of the name is 'k', reverse the name, else append 'v' after the name.
If length of the name is not 20 and first letter of the name is not 'u', reverse the name, else reverse the name.
If length of the name is not greater than 46, append 'v' after the name, else append 'f' after the name.
If first letter of the name is not 'i', do nothing, else append 'z' after the name.
If length of the name is not less than 38, reverse the name, else append 'b' after the name.
```

But it is still very hard for bears to do the transforms precisely. So they ask you - a human who can use computer program - to solve the request. Can you help them?

Input

Input contains single string $s(1 \leq |s| \leq 50)$ consists of lowercase English letter - the original name your program need to operate.

Output

Output the desired name in a single line.

Examples

stdin	stdout
winnie	vidniansutwinnieoemqcaivozkloipvb
tommmmmmmmmmmmmmmmy	vpiolkcqmeoymmmmmmmmmmmmmmmmottustaiyavozniv
pneumonoultramicroscopicsilicovolcanoconiosis	fpiolzoviaylqejatstpneumonoultramicroscopicsilicovolcanoconiosisqiwckpniv

Notes

Examples are wrapped into multiple lines for clarity. There's only a single line in the test data.

The statement may be too narrow to show all content clearly. You are allowed to copy it from the website to local editor for convenience.

Problem F. Final Spark

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

Lux has a plan to eliminate the invisible motionless enemy Teemo, whose location is detected by the Oracle Lens. She decides to cast an ultimate skill immediately, which would slay Teemo if hit because Lux has very high ability power.

Lux's ultimate skill, Final Spark, is a powerful skill which can damage enemies by a straight beam of light with infinite length and w meters width. It will deal damage to who shares at least a point with the light beam.

Channelling Final Spark, screenshot in *League of Legends*

But Teemo - The Swift Scout - is a well-trained soldier. He will fleetly react to the Lux's action, and try to dodge the ray by choosing a uniformly random direction and run along the direction. Between the first action of Lux and the moment the ray finally pokes out, Lux needs time to channel the ultimate, and during the channelling Teemo can run s meters - note that Teemo always run in a straight line.

She should choose the direction of the Final Spark before any action is taken. At the instant before Lux casting the ultimate skill using the best strategy, she wonders how possible is the skill hit Teemo. She recalls that Teemo can be recognized as a circle with radius r meters, and now Teemo is d meters away from Lux.

It's very hard for Lux to calculate it. Can you answer Lux the possibility of hitting Teemo when she uses the best strategy?

Input

The first line contains an integer $T(1 \le T \le 10^5)$ - the number of test cases.

Each test case description contains the only line with four integers, w, r, s, d ($1 \le w, r, s \le 1000$, $1 \le d \le 3000$) - the width of light beam, radius of Teemo, the distance Teemo can run during Lux channelling her Final Spark, the distance between Lux and Teemo.

It is guaranteed that $w + r + s < d$, so Teemo can not run through Lux, and the start of the light beam can not touch Teemo.

Output

For each test case, print a single number denoting the maximum possiblity on a separate line. The absolute error should not exceed 10^{-6}.

Formally, let your answer be A, and the jury's answer be B. Your answer is accepted if and only if $|A - B| \leq 10^{-6}$.

Examples

stdin	stdout
3 20 20 20 1000 0 0 100 1000 100 100 198 2000	1.000000000 0.000000000 0.503215306

Notes

In the first case of the example, Lux will shoot along the direction exactly through the center of Teemo. Teemo is unable to escape.

In the second case of the example, wherever Lux shoot, the possibility is 0 because the possible position of Teemo forms a circle with radius 100, but the width of the ray and the radius of Teemo are both 0.

Problem G. Goldbach's conjecture

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

If you always repay, you could always borrow easily. It can be classified and discussed one by one.

- Mr. Proof

Goldbach's conjecture is one of the oldest and best-known unsolved problems in number theory and all of mathematics. It states:

Every even integer greater than 2 can be expressed as the sum of two primes.

At the beginning of the year 2019, Mr. Proof 'proved' Goldbach's conjecture and published it at Zhihu. No matter how ridiculous his proof was, you - the Math Genius - knows that Goldbach's conjecture is true with your godlike mathematical intuition. You know that it's hard to prove, but you can show that with your extraordinary programming skills. You decided to write a program to show its correctness, also show your gratitude to Mr. Proof making a brave step forward to the truth - though he failed and scoffed by many.

Note that we can not provide a super computer as you have, so that your program will be tested using numbers under 10^9.

Input

Input contains single *even* integer $n(2 < n \leq 10^9)$ - the number you need to prove to meet Goldbach's conjecture.

Output

Output two primes seperated by a single space in a single line. The sum of primes should be equal to n.

If there are multiple answers, print any.

Examples

stdin	stdout
4	2 2
6	3 3
8	3 5

Notes

'5 3' is also a correct answer for sample input 3.

Problem H. Hazardous

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

Viruses are hazardous. Controlling viruses is hard.

In order to prepare for potential virus incoming, Country H need to investigate the hazard score for every administrative division. Abstractly Country H's hierarchy forms a rooted tree that every vertex is a level of administration - like province, city, county, town, etc. The root is vertex 1. Every vertex has its color which indicates the living habits of local residents - people are more likely to transport between vertices of the same color.

The hazard score for every vertex is calculated as the sum of distance of all pairs of different vertices in the subtree of the vertex that have the same color. The distance between two vertices is calculated as the minimum number of edges it need to transport between two vertices.

Time is life. You are hired to calculate the hazard score for every vectex in Country H as fast as possible.

Input

The first line contains a integer $n(1 \le n \le 10^5)$ - the number of vertices.

The second line contains n integers, the i-th number $c_i(1 \le c_i \le n)$ denotes the color of vertex i.

Each of the next $n-1$ lines contains 2 integers $u_i, v_i(1 \le u_i, v_i \le n)$ - the ends of the i-th edge.

It's guaranteed that the edges forms a tree containing n vertices.

Output

Output n lines, on the i-th line print a single integer denoting the hazard score for subtree i.

Examples

stdin	stdout
5 1 2 1 1 2 1 2 2 3 2 4 5 1	8 2 0 0 0

Notes

Here's the illustration for example: