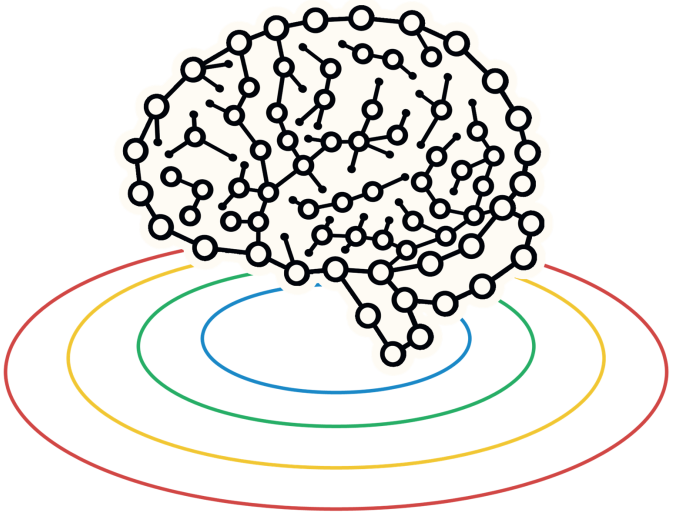

ALGOLYMPICS 2018

UP ACM PROGRAMMING COMPETITION

CONTEST PROBLEMS

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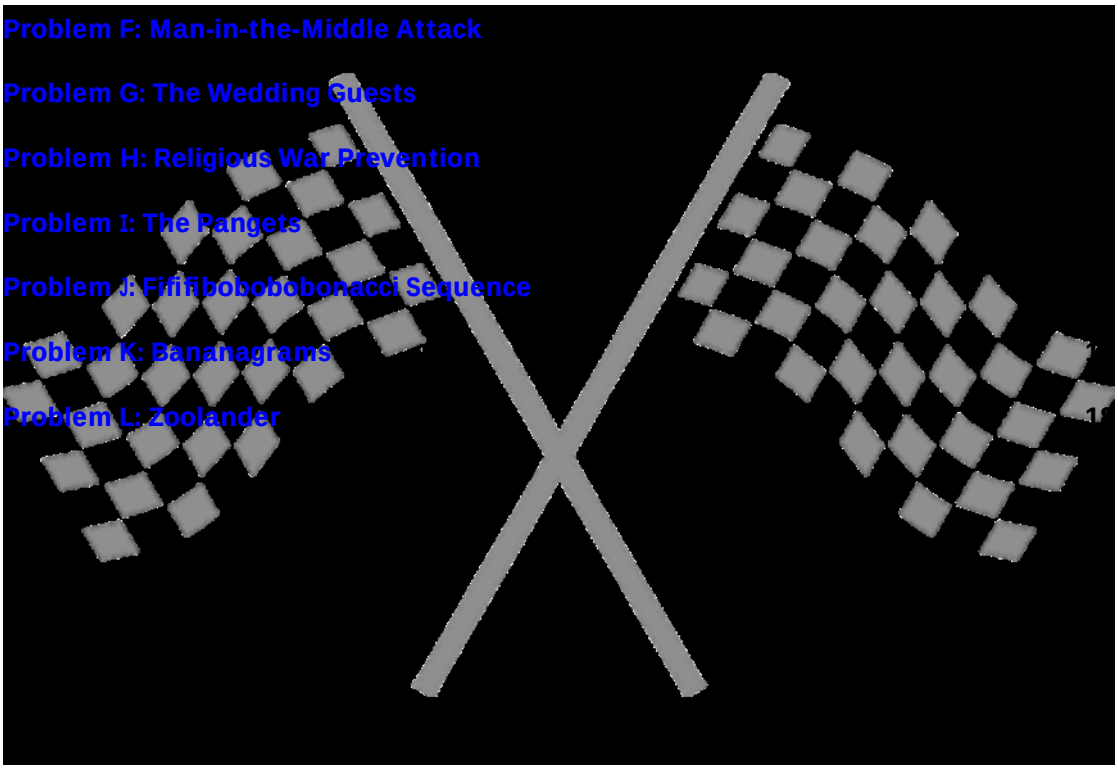


Problem A

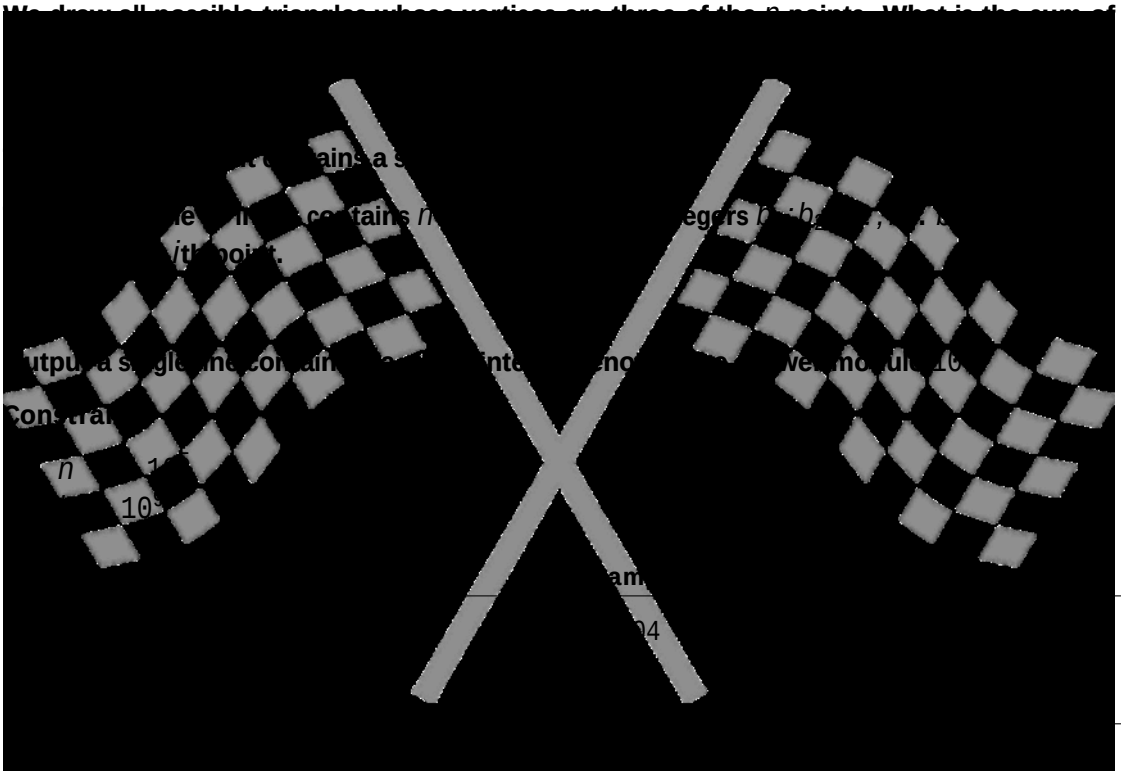
Triangles

Time Limit: 2 seconds

There are n points, no three of which are collinear. Each point has an integer, called its beauty, representing how beautiful it is. If the integer is higher, then it means that the point is more beautiful.

The cuteness of a triangle is equal to the beauty of its least beautiful point. The hotness of a triangle is equal to the beauty of its most beautiful point. The wow factor of a triangle is equal to the product of its cuteness and hotness.

We draw all possible triangles whose vertices are three of the n points. What is the sum of



Input

The first line contains a single integer n.

The second line contains n integers $b_1, b_2, \ldots, b_n$, where b_i is the beauty of the ith point.

Output

Output a single line containing a single integer equal to the wow factor modulo $10^9 + 7$.

Constraints

- n
- 10^5

Sam

04

Problem B

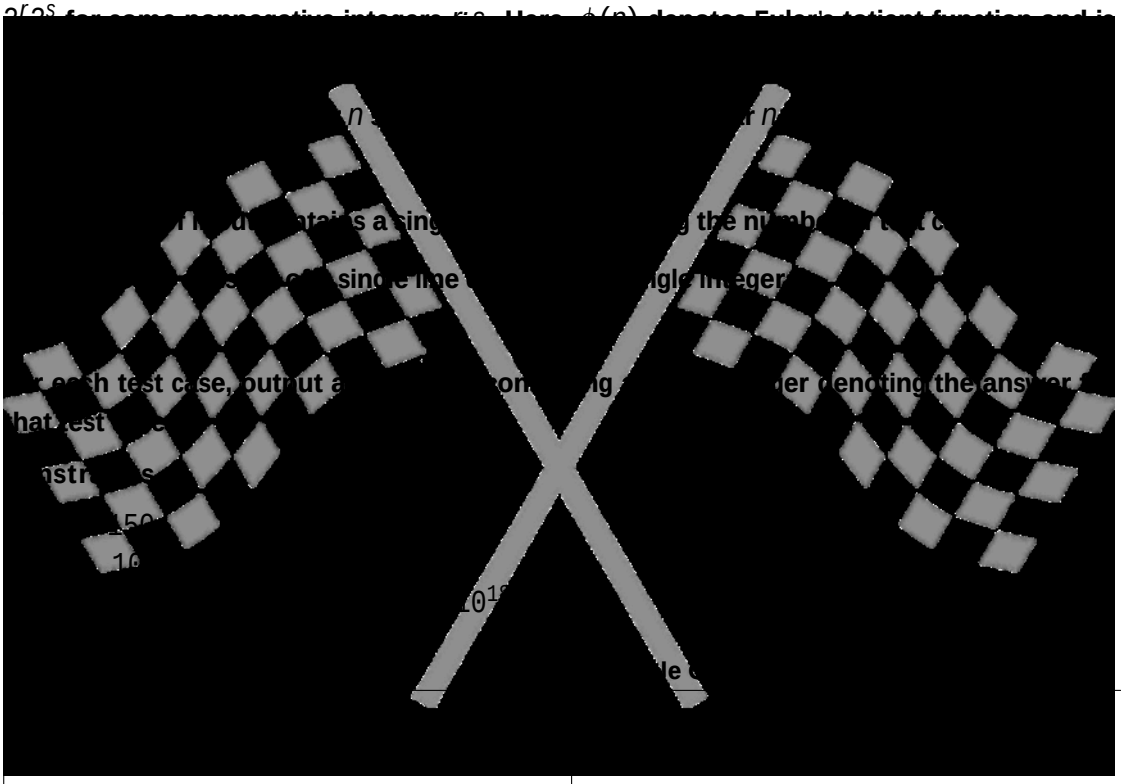
Superconstructible

Time Limit: 4 seconds

Not all regular n-gons are constructible with a compass and straightedge; Gauss was the first to discover exactly which regular n-gons are constructible.

If we allow for an additional tool called an *angle trisector* (which allows us trisect any given angle), then we are able to construct more regular n-gons. Let's call a regular n-gon that is constructible with a compass, straightedge, and an angle trisector superconstructible.

It can be shown that, for n 3, the regular n-gon is superconstructible if and only if $\phi(n) =$ $2^r 3^s$ for some nonnegative integers r, s. Here, $\phi(n)$ denotes Euler's totient function, and is

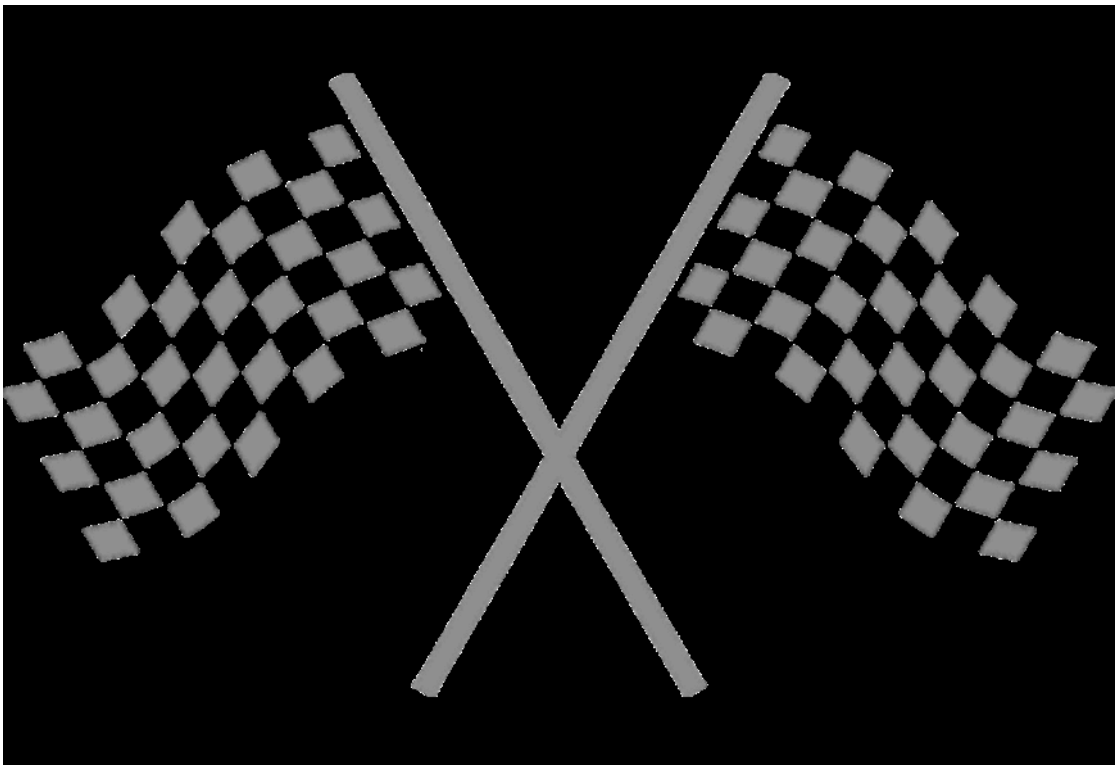


2 3 4 5 111 1206	5 6 7 240 13824

Explanation

The regular 7-gon is famously known to not be constructible with a compass and straightedge, but it is superconstructible.

On the other hand, it can be shown that a regular 11-gon is not constructible even with an angle trisector, hence it is not superconstructible.



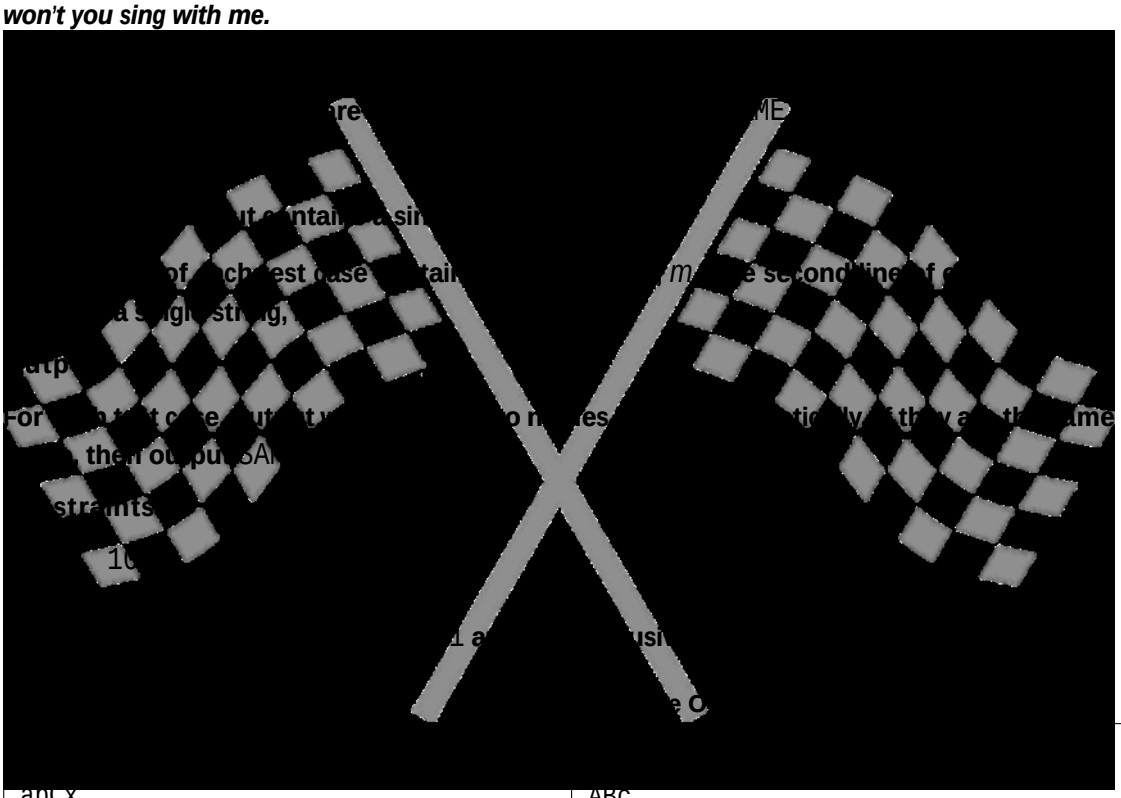
Problem C

Jejeland

Time Limit: 3 seconds

In Jejeland, people always write their names in whatever combination of cases they feel during that time. For example, Adonis might write his name as `aDoNiS` or `Adonis`, etc. This is a nightmare for the secretaries in Jejeland since they want to sort their files truly alphabetically. In particular, a name like `Cobert` will come before `Cubert`, irregardless of the cases of the letters. In case you have forgotten the alphabet, let us sing it together:

A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z. Now I know my ABCs next time won't you sing with me.



abCx CabX cAB ABc lol LOL	ABc SAME!

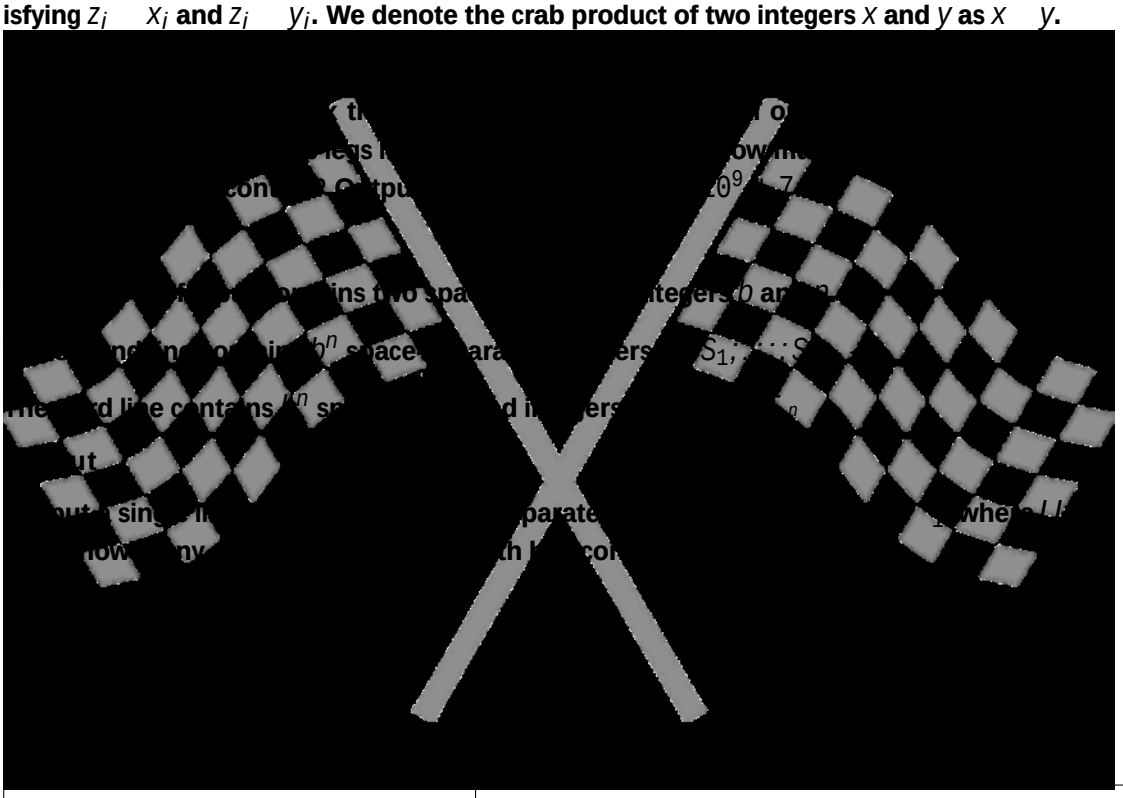
Problem D

Crab Product

Time Limit: 1 second

Suppose you are given an integer $b \quad 2$ and a non-negative integer n. We can associate a non-negative integer $x < b^n$ uniquely to an ordered n-tuple $(x_0;x_1;:::;x_{n\ 1})$ where 0 $x_i < b$ and $x = x_0b^0 + x_1b^1 + ::: + x_{n\ 1}b^{n\ 1}$.

Suppose x and y are non-negative integers less than b^n where x is associated to $(x_0;::::;x_{n\ 1})$ and y is associated to $(y_0;::::;y_{n\ 1})$. Then we say that their crab product is the non-negative integer z associated to the ordered n-tuple $(z_0;::::;z_{n\ 1})$ where z_i is the largest integer satisfying $z_i \quad x_i$ and $z_i \quad y_i$. We denote the crab product of two integers x and y as $x \quad y$.



3 2 3 4 50 6 2 300 3 1 30 9 7 199 5 6 6 2 4 100	6810 5066 80920 3058 3424 31980 380 224 3000

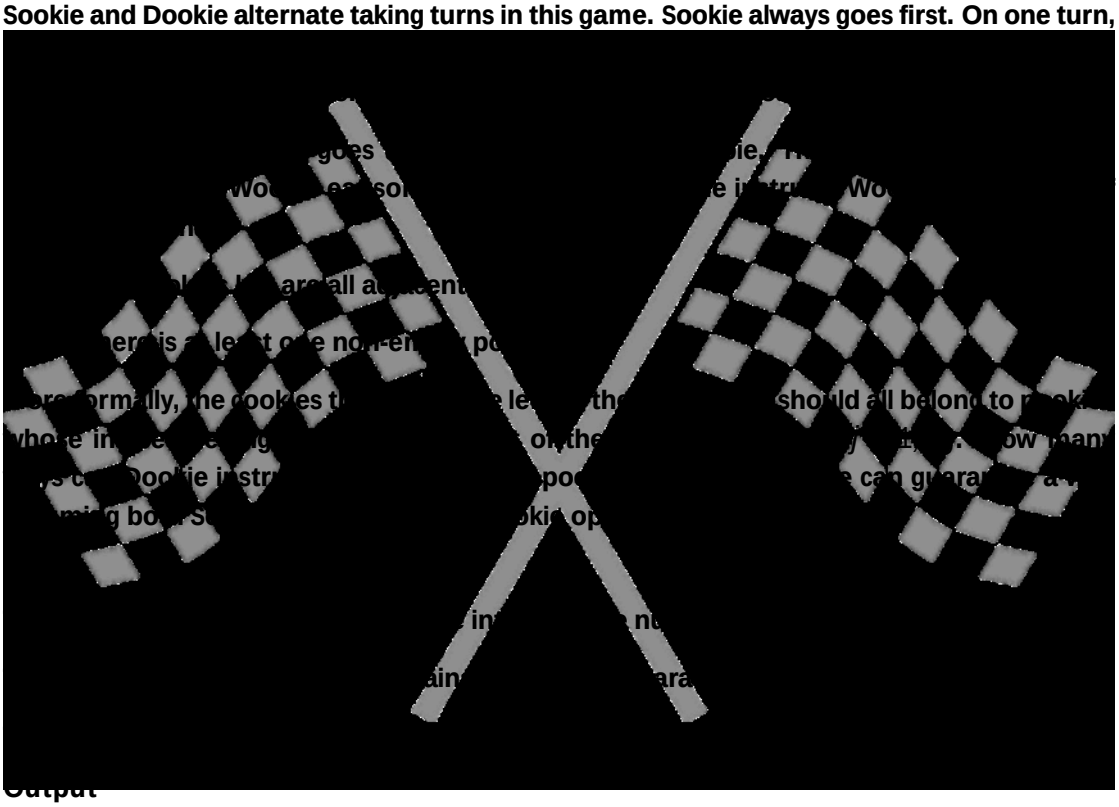
Problem E

Cookie

Time Limit: 2 seconds

Sookie and Dookie likes to play the game Cookie. Cookie is played with n di□erent piles of cookies, called pookies. These pookies are indexed from 1 to n, where pookie 1 is the leftmost and pookie n is the rightmost. The first m pookies have $A_1; A_2; : : : ; A_m$ cookies. More specifically, A_i is the number of cookies on the ith pookie for $i \quad m$. For $j > m$, the jth pookie contains the same amount of cookies as the mth pookie to its left. From this description, it can be deduced how much each of the n pookies contain.

Sookie and Dookie alternate taking turns in this game. Sookie always goes first. On one turn,



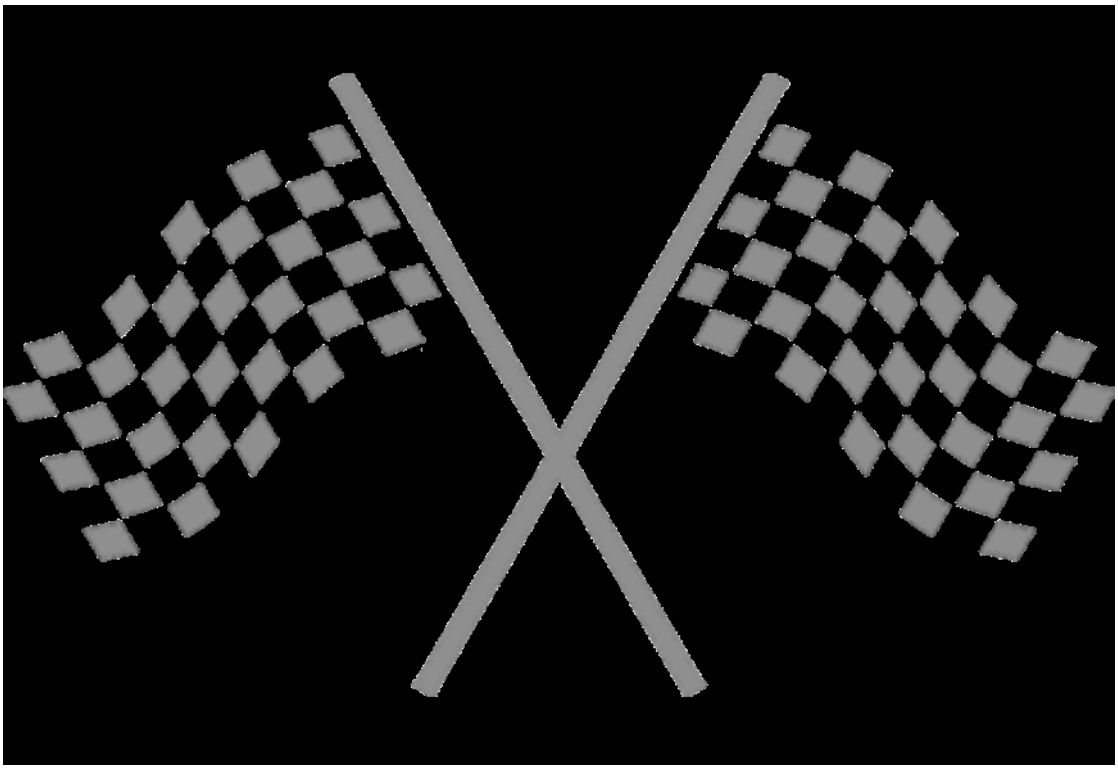
Output

For each test case, output a single line containing a single integer denoting the answer modulo $10^9 + 7$.

Constraints

$1 \quad t \quad 5$
$1 \quad m \quad 10^5$
$m \quad n \quad 10^{18}$
$0 \quad A_i \quad 10^9$

Sample Input	Sample Output
1 6 4 1 1 2 3	6



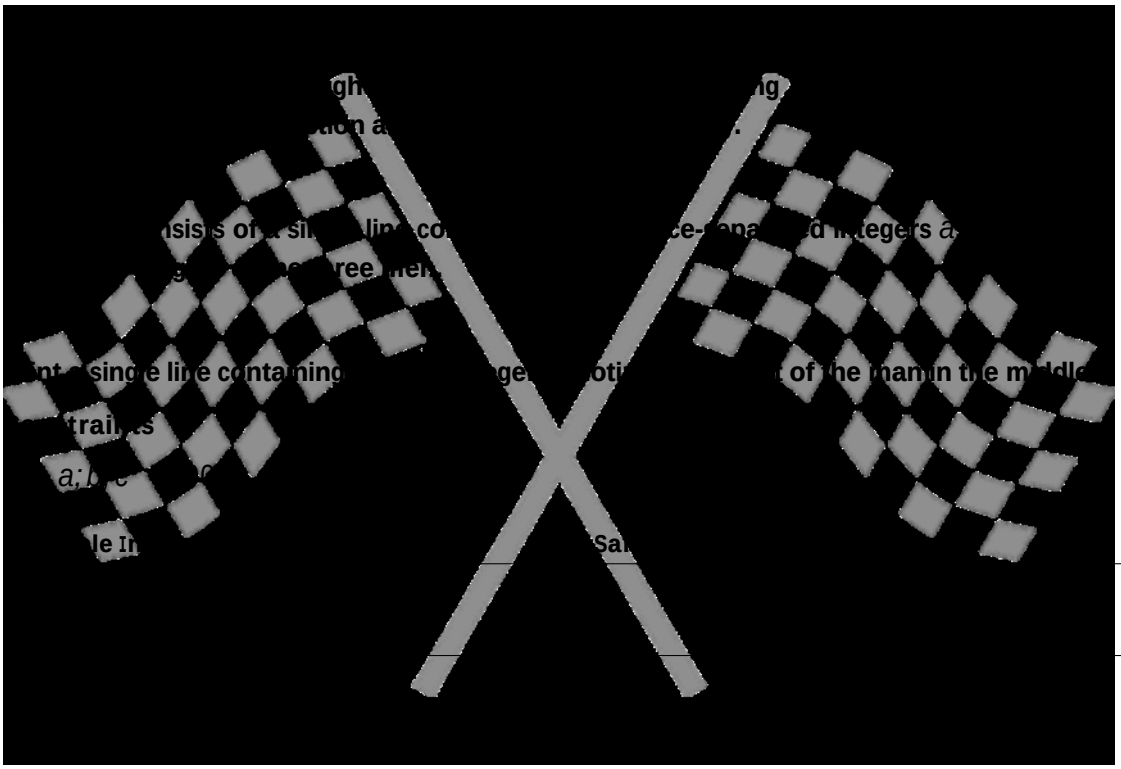
Problem F

Man-in-the-Middle Attack

Time Limit: 3 seconds

Cryptographers and security experts are very wary of di□erent types of attacks in a cryptosystem. The most dangerous of them all is the man-in-the-middle attack. In this attack, three men arrange themselves by height. And then the man in the middle attacks.

For their safety, cryptographers follow a piece of advice from Michael Jackson that they misheard. Whenever they need to defend their cryptosystem, they're starting with the man in the middle. In particular, they want to determine which one among a group of three men will become the man in the middle.



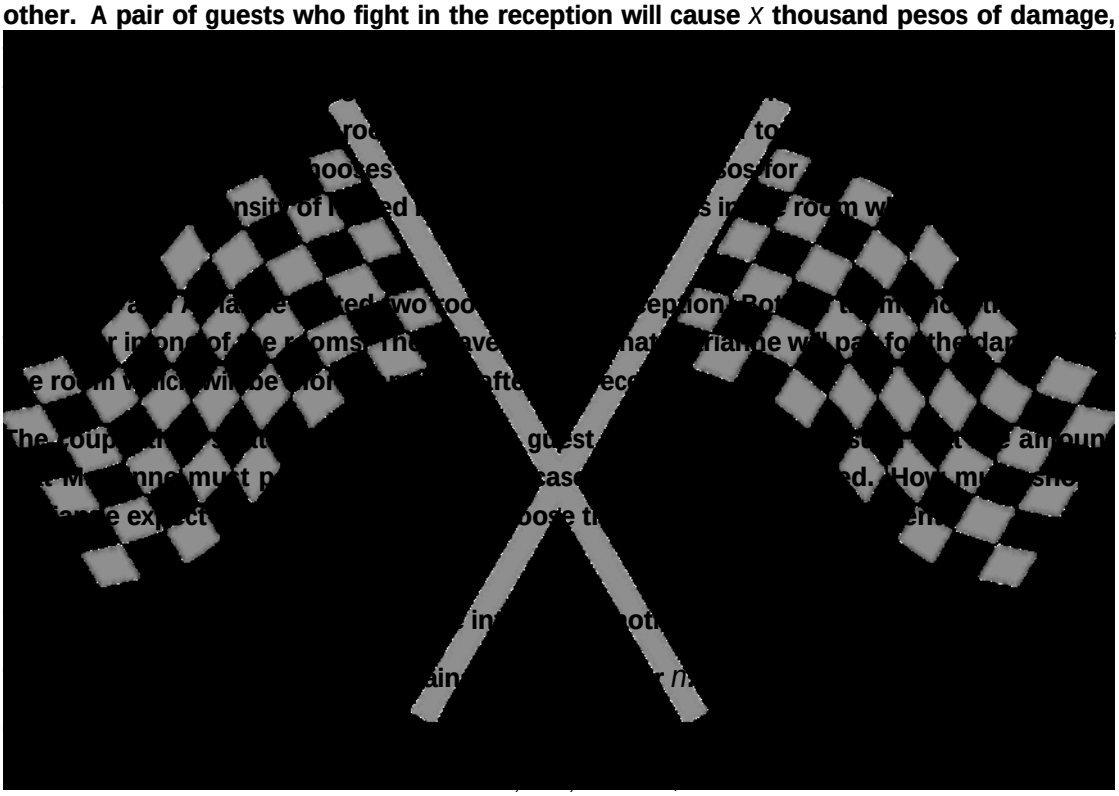
Problem G

The Wedding Guests

Time Limit: 2 seconds

There are n di□erent guests invited to Marianne and Arrianne's wedding reception. We index the guests from 1 to n. Everyone hates each other. They intensity of how much a pair of guests hate each other is represented by an integer. Unlike love, hatred is reciprocal. If guest i hates guest j with intensity k, guest j hates guest i with intensity k as well. Weirdly enough, all guests love themselves. The intensity in which they hate themselves is 0.

In the reception, the couple expects that exactly one pair of guests will fight among each other. A pair of guests who fight in the reception will cause x thousand pesos of damage,



$h_{i;j}$ **represents the intensity of how much guests i and j hate each other.**

Output

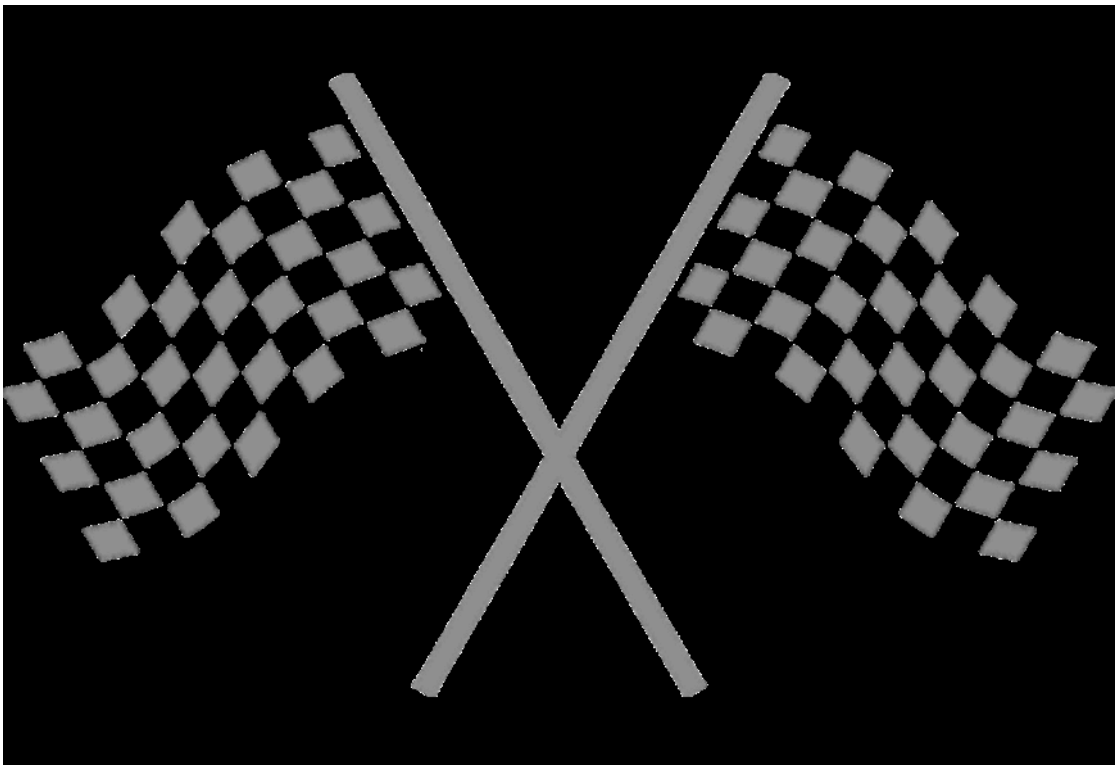
For each test case, output a single line containing a single integer denoting the answer.

Constraints

$1 \quad t \quad 26$
$1 \quad n \quad 1000$
$1 \quad h_{i;j} \quad 10^7$ **for** $i \neq j$
$h_{i;i} = 0$

The sum of all n^2 is $5\ 10^6$

Sample Input	Sample Output
1 3 0 69 0 11 42 0	11



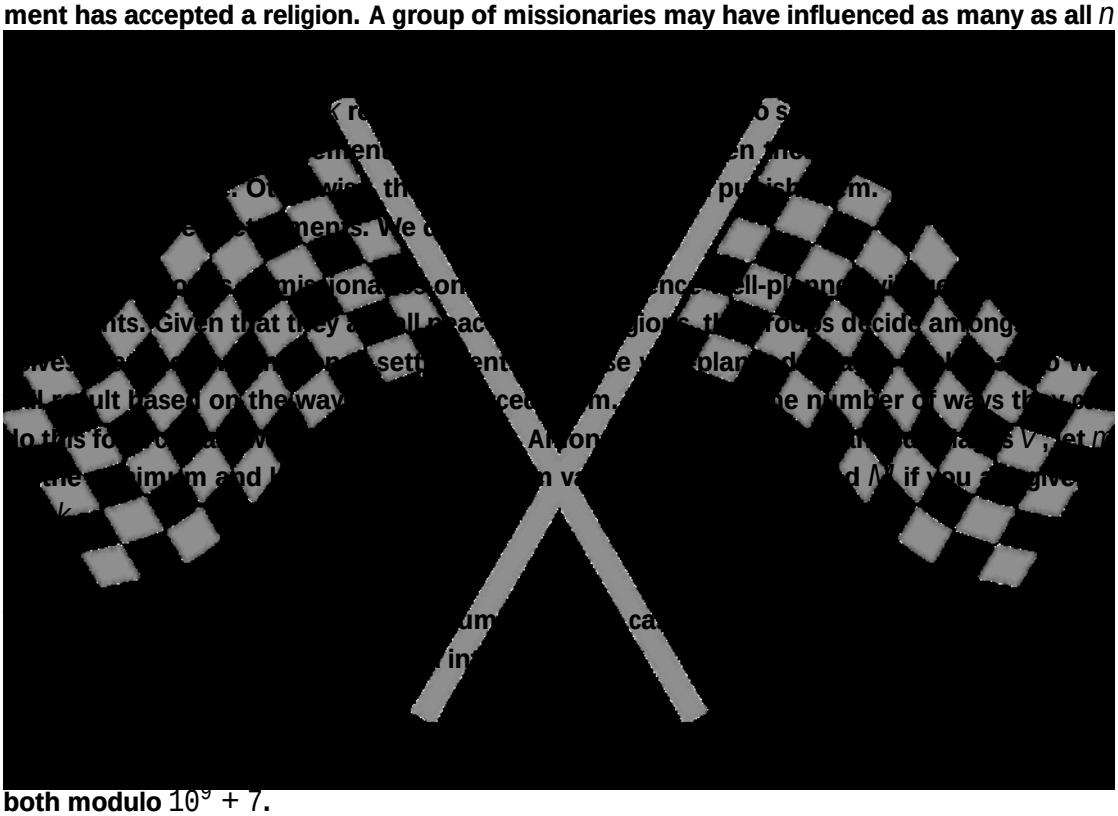
Problem H

Religious War Prevention

Time Limit: 2 seconds

A village has n di□erent settlements and n 1 di□erent bridges. We call the village a well-planned village if there is a unique path (sequence of bridges) that can be taken to go from any of the n settlements to another.

There are k di□erent groups of missionaries, each with a di□erent religion. They can influence settlements to become their religion. Once a settlement accepts their religion, they will be of that religion forever. At the end of the missions of the k di□erent groups, each settlement has accepted a religion. A group of missionaries may have influenced as many as all n



both modulo $10^9 + 7$.

Constraints

$1 \quad t \quad 1500$
$1 \quad n;k;nk \quad 10^9$

Sample Input	Sample Output
1 3 2	6 6

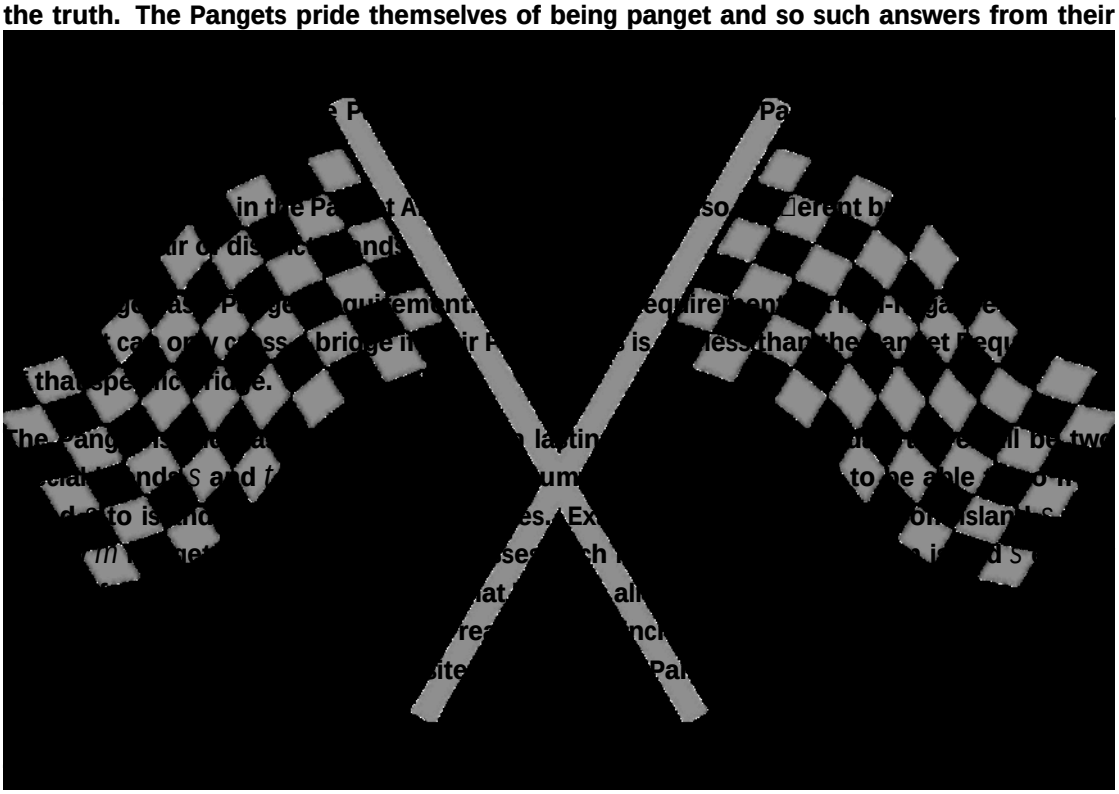
Problem I

The Pangets

Time Limit: 2 seconds

There is a group of people, collectively known as The Pangets, who have decided to live in their own set of islands. These islands are indexed from 1 to n. The ith island has been blessed g_i times.

The Pangets have decided to live amongst themselves, away from the real world, because their girlfriends lie about them. In particular, whenever a friend asks their girlfriend what type of person they are, the girlfriends respond by saying "Mabait" or "Maginoo" instead of the truth. The Pangets pride themselves of being panget and so such answers from their



The second line contains n space-separated integers $g_1; g_2; \ldots; g_n$.

The next b lines describe the bridges. Specifically, each of the next b lines contains three space-separated integers x, y, r which means that a bridge that has a Panget Requiremen of r connects islands x and y.

The next q lines describe the days of the annual tradition. Specifically, each of the next q lines contains two space-separated integers s and t.

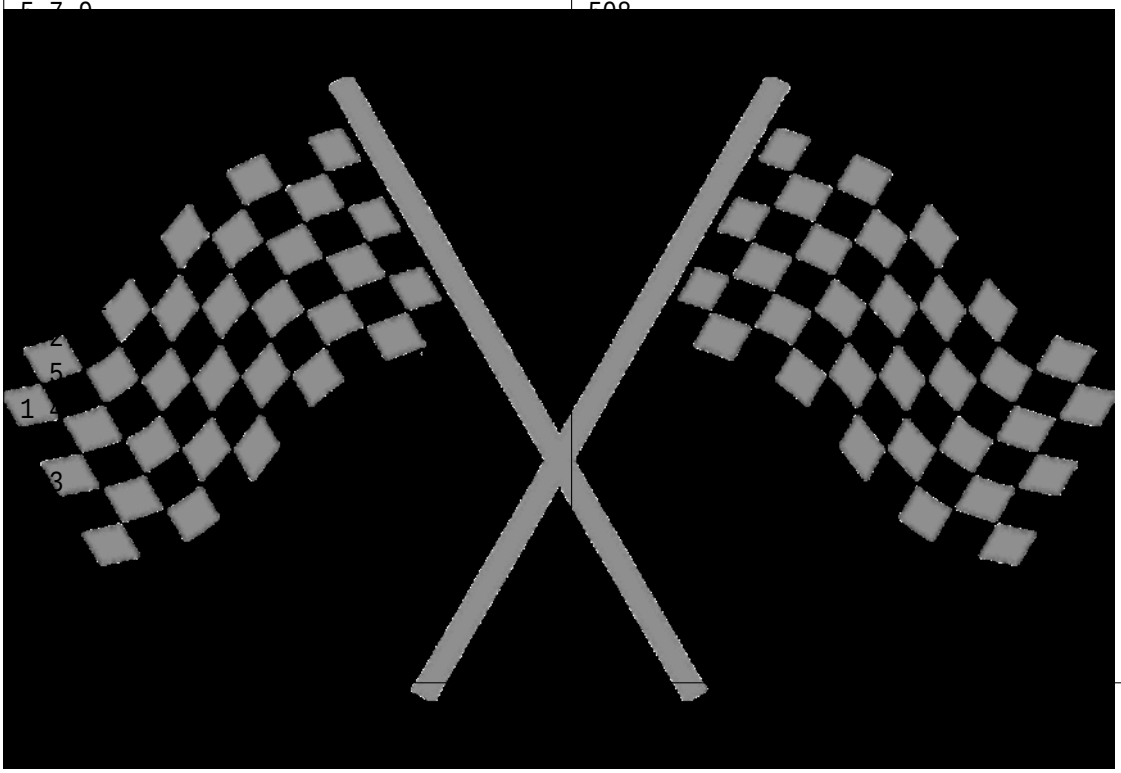
Output

For each day of the annual tradition, print the sum of the g_i over all islands visited by that day's Panget Priest.

Constraints

2 n 150000
1 b 200000
1 q 100000
1 $r; g_i$ 10^6
1 $x; y; s; t$ n
$x \neq y$
$s \neq t$
There is a path between any pair of islands.

Sample Input	Sample Output
5 7 0 2 5 1 4 3	508



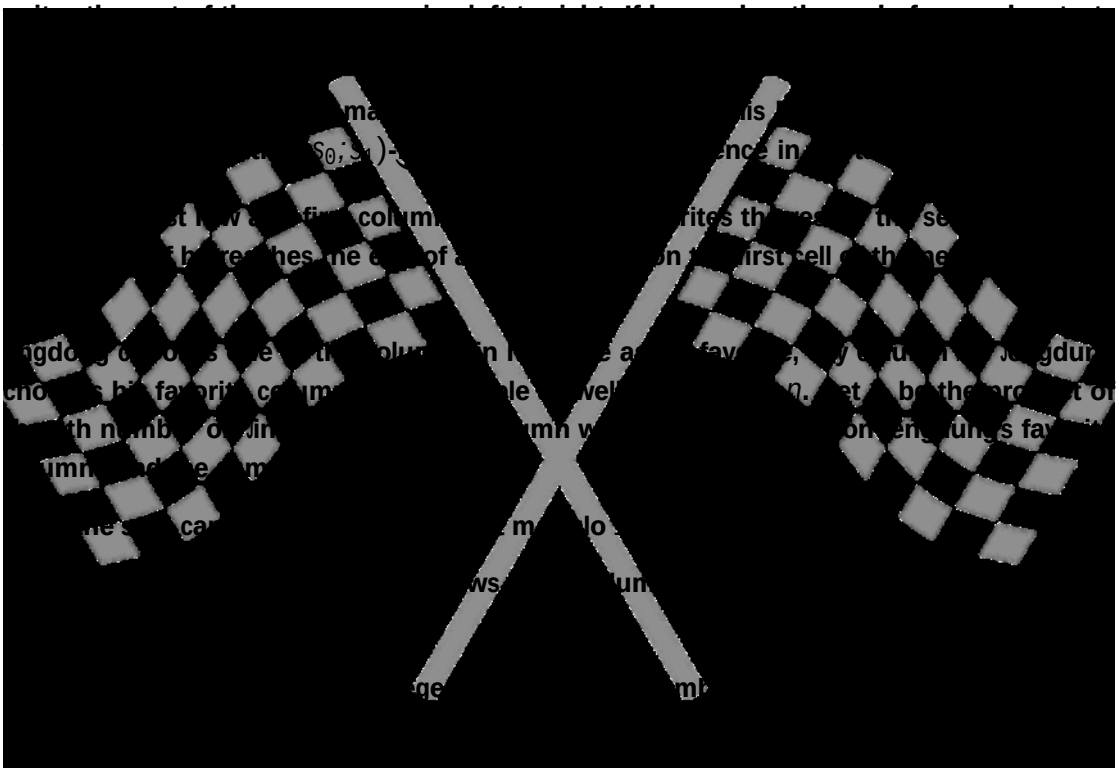
Problem J

Fifififibobobobonacci Sequence

Time Limit: 2 seconds

The (S_0, S_1)-fi$\underbrace{\text{fi}}_{a}bo\underbrace{\text{bo}}_{b}$nacci sequence is a sequence whose 0th term is S_0, 1st term is S_1, and whose ith term is $aS_{i-1} + bS_{i-2}$ when $i \geq 2$. For example, the first few terms of the $(1, 2)$-fifififibobobobonacci sequence starts with $1, 2, 10, 38, 154, \ldots$

Jingdong Dantes makes a $u \times v$ table. He writes the terms of the (S_0, S_1)-fi$\underbrace{\text{fi}}_{a}bo\underbrace{\text{bo}}_{b}$nacci sequence in his table, starting on the cell on the first row and first column of the table. He



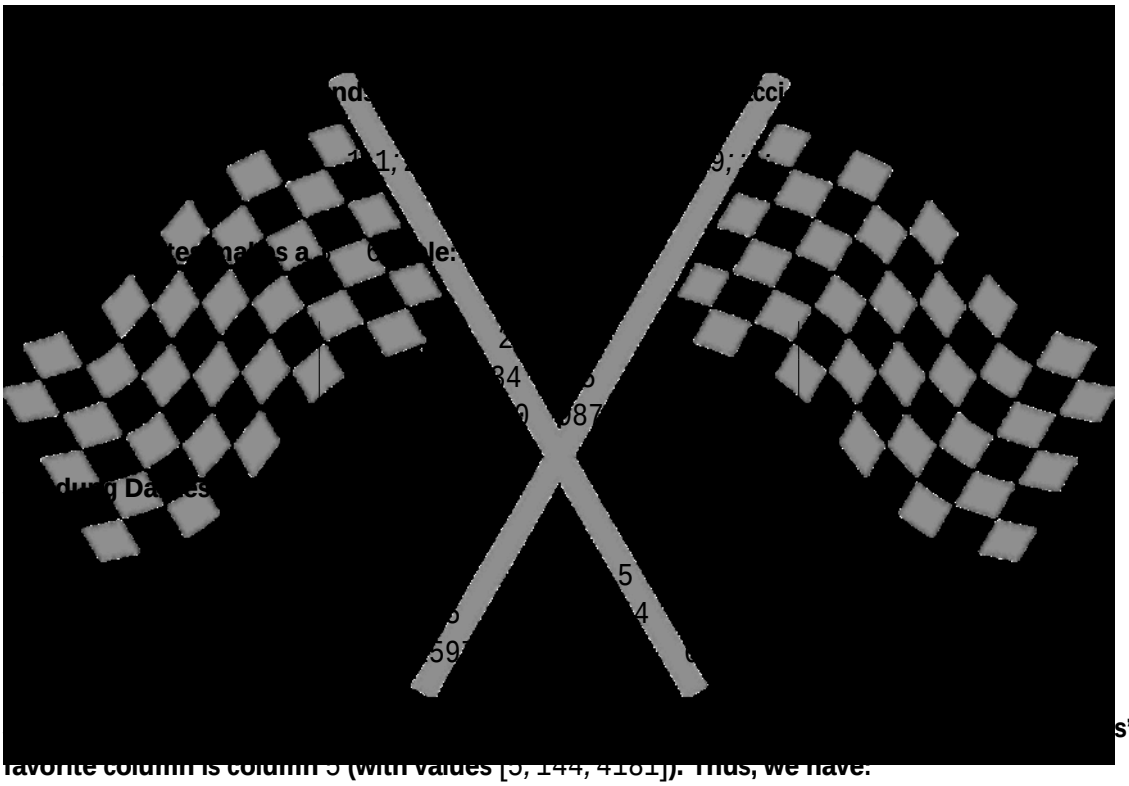
Output

Output a single line containing a single integer denoting the answer.

Constraints

$1 \leq t \leq 8000$
$1 \leq a, b, u, v, w, S_0, S_1 \leq 10^{18}$
$1 \leq m \leq v$ **and** $1 \leq n \leq w$

Sample Input	Sample Output
8 1 1 2 5 3 6 7 1 1 3 4 2 5 3 6 7 1 2 3 4 2 5 300 6 7 1 2 3 4 2 5 30000 6 7 1 2 3 4 2 5 3 6 7 6 9 3 4 2 5 300 6 7 6 9 3 4 2 5 30000 6 7 6 9 420 69 6 9 420 69 96 1234 4321	1579266 273843983 374629028 899749965 876364534 113653566 159483974 816278509



favorite column is column 5 (with values [5, 144, 4181]). Thus, we have:

$$t_1 = 1 \ \ 5 = 5$$
$$t_2 = 21 \ \ 144 = 3024$$
$$t_3 = 377 \ \ 4181 = 1576237$$

Thus, the required output for the first test case is $5 + 3024 + 1576237 = 1579266$**. Modulo** $10^9 + 7$**, this is still** 1579266**.**

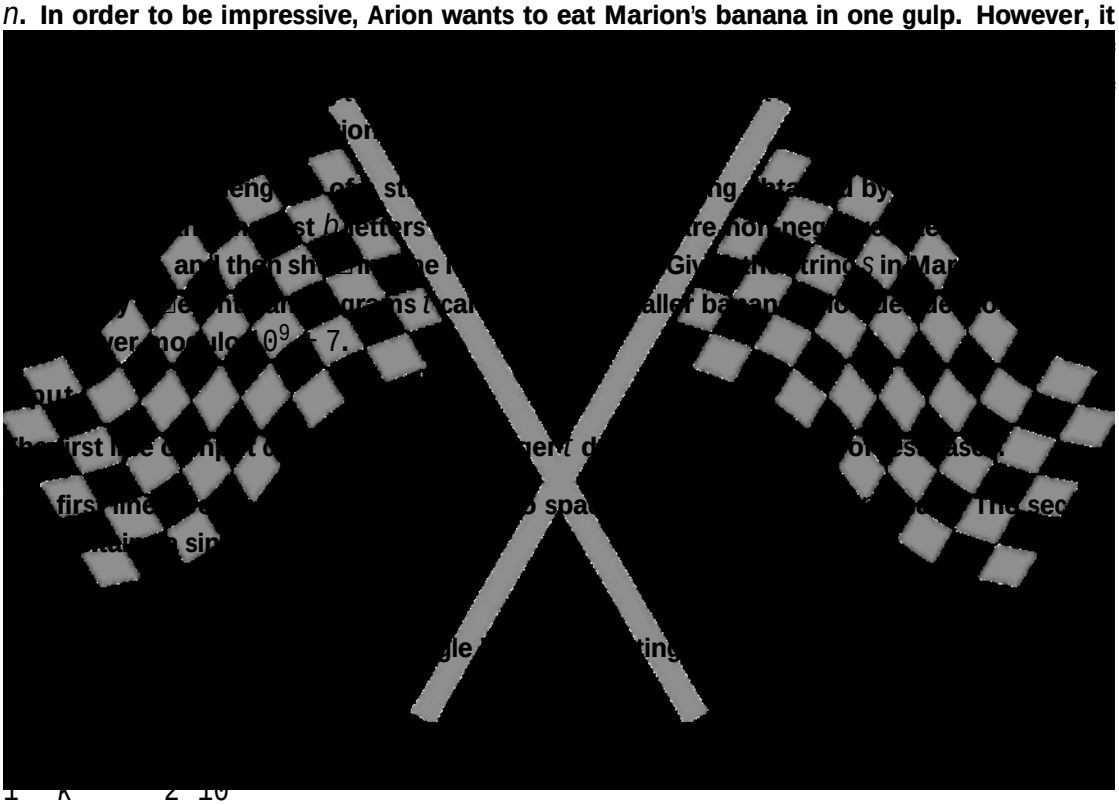
Problem K

Bananagrams

Time Limit: 3 seconds

Marion and Arion live in a magical place where bananas have letters on them. In particular, if the banana is c centimeters long, it will have exactly c letters on it. Thus, we can talk about the strings written in bananas. In particular, a banana of length c centimeters can be represented by a string of length c. For the purposes of this problem, assume that all bananas are integer length.

Marion has a big banana. Its length is n centimeters long and it contains the string s of length n. In order to be impressive, Arion wants to eat Marion's banana in one gulp. However, it



$1 \le k \le 2 \cdot 10$

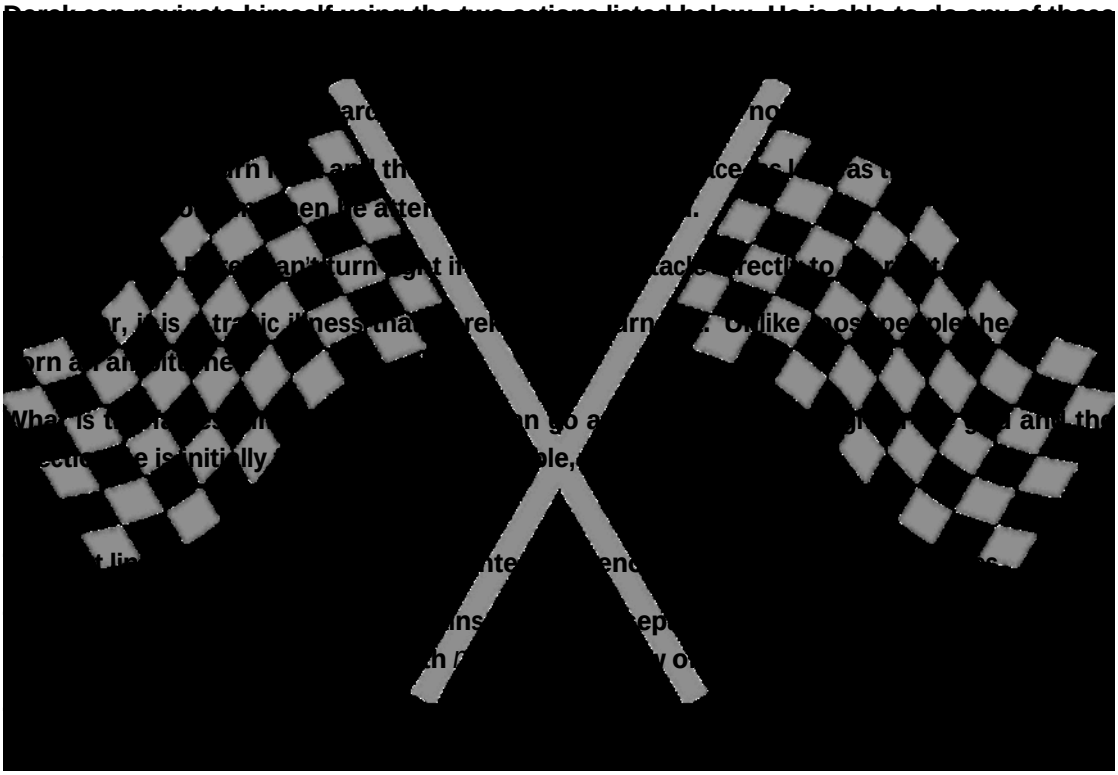
s consists of lowercase English letters.

Sample Input	Sample Output
1 3 bananaman	21

Problem L
Zoolander
Time Limit: 2 seconds

Derek needs to go to save his friends who are in the gas station. His friends had a party where they would throw gas at each other. However, things went wrong when a stray cigarette suddenly lit the gas on fire. It's up to Derek to save them![1]

The map is represented by an n m grid. Derek is at the cell marked with ^, >, v or <, and his friends are at the cell marked F. The rest of the grid is either . or #. Cells marked . are passable while cells marked # are obstacles.



Output

For each test case, output a single line containing a single integer denoting the fastest time in which Derek can go and save his friends, or the string IMPOSSIBLE if it is impossible.

Constraints

$1 \quad t \quad 2\ 10^5$
$1 \quad n;m \quad 100$
The sum of all nm is $2\ 10^6$
There is exactly one ^, >, < or v.

[1] **...after he gets his orange mocha frappuccino, of course!**

There is exactly one `F`**.**
The rest of the grid consists of either `.` **or** `#`**.**

Sample Input	Sample Output
2 5 6 ..#... .F.... ..^#.. .... 5 4	10 IMPOSSIBLE