Problem A. Oscar and English

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Oscar is one of the most famous school idols, and she has a strange habit of writing english sentences.

Specifically, lowercase and uppercase characters appear alternatively. For example, for the word 'Oscar', she may write 'OsCaR' instead.

Now, as her fan, you also want to write english sentences in the way she does. Moreover, the first letter of each word will always be uppercase.

Input

There is only one string of length $n(n \leq 100000)$ in one line, indicating the word you want to write. It is guaranteed that this string only contains english characters, ',' and '.'. No space will occur in the string.

Output

Output one string in one line.

Example

standard input	standard output
`EverybodylovesOscar.Go,Oscar,Go.`	`EvErYbOdYlOvEsOsCaR.Go,OsCaR,Go.`

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Problem B. Oscar and Coin Game

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Oscar and Sakuya are playing a game with coins. N coins are arranged in a row, numbered from 1 to N. Initially, the odd-indexed coins are heading up, and the even-indexed coins are tailing up. The i-th coin has a value of S_i.

The game consists of $N-1$ turns, numbered from 1 to $N-1$. Oscar plays the odd-indexed turns, while Sakuya plays the even-indexed turns.

In the i-th turn, the corresponding player needs to choose exactly one of the three operations below:

- flip the i-th coin(head-up to tail-up, or tail-up to head-up).
- flip the $i+1$-th coin.
- do nothing.

After the $N-1$ rounds, Oscar takes all the head-up coins and Sakuya takes all the tail-up coins. Both players will take the optimal strategy to maximize the sum of values of the coins they get.

Additionally, there are Q updates of coin values. In the i-th update, the value of coin P_i decreases by D_i. You need to output $Q+1$ answers: the i-th answer indicates the sum of values Oscar gets if we apply the first $i-1$ updates before the game.

Input

The first line contains an integer $N(1 \le N \le 2*10^5)$, indicating the number of coins.

The next line contains N integers $S_1, S_2, \cdots, S_N (1 \le S_i \le 10^9)$, indicating the values of the coins.

The next line contains an integer $Q(0 \le Q \le 2*10^5)$, indicating the number of operations.

The next Q lines describe the operations. The i-th line contains two integers P_i and $D_i(1 \le P_i \le N, 1 \le D_i)$.

It's guaranteed that each coin has a positive value at any time.

Output

Output $Q+1$ lines, indicating the answers.

Example

standard input	standard output
n 4 SVJ 1 2 3 4 Q 1 changes 4 3	7 5

Problem C. Oscar and Tournament

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Oscar arranges n students to hold a table tennis tournament.

Numbered from 1 to n, each student i has a unique skill level s_i. In each game, two students play, and the student of higher skill level always wins. Because it is a tournament, the player who loses is immediately eliminated from the tournament and cannot compete in the following games. The tournament lasts until there is only one player left.

Since students are very busy, they don't want to participate in too many games. Specifically, the student i plays at most g_i games in the tournament.

As the organizer, Oscar is free to choose who will be competing in each game as long as they are not eliminated. Now he wants to know how exciting the tournament can be.

Let's assume two students x and y are competing in a game. The exciting value of this game will be

$$E(x, y) = (x \oplus y) + x + y$$

.

$\oplus$ denotes the exclusive or operation.

The excitement of the whole tournament is simply the sum of the excitement of each game, now you need to compute the maximum possible value of the tournament.

Input

The first line of input contains a single integer $n (3 \leq n \leq 100)$, which is the number of students.

Each of the next n lines contains two integers $s_i (0 \leq s < 2^{30})$ and $g_i (2 \leq g < n)$. We guarantee that all s_i are distinct.

Output

Output the answer in one line.

Example

standard input	standard output
4 39 2 76 2 28 3 11 3	506

Problem D. Oscar and Election

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Sakuya Primary School's presidential election is underway. Sakuya Primary School consists of n cities, numbered from $1, 2, \cdots, n$. Each city has one vote. There are two political parties participating in the election: the Red Party and the Blue Party. The vote choices of the cities are known. The election adopts the winner-take-all rule: The cities are divided into several states and the winner in each state takes ALL the votes in the state.

For example, if there are 3 cities voting for the Red Party and 2 cities voting for the Blue Party in a state, the Red Party gets all the 5 votes from the state. Notice that each Party gets half of the votes in the state if the election in the state ends with a draw. For example, if there are 2 cities voting for the Red Party and 2 cities voting for the Blue Party in a state, Both Parties get 2 votes.

Oscar is the current President of Sakuya Primary School and she has the right to change the state division. A valid division must guarantee that the cities in a state have continuous indexes and each city belongs to exactly one state. You hope that the Red Party wins as many as possible votes. Can you find the best strategy of division to help the Red Party?

Input

There are multiple test cases. The first line of the input contains an integer T, indicating the number of test cases. For each test case:

The first line contains an integer $n (1 \le n \le 10^5)$, indicating the number of cities in Sakuya Primary School.

The next line contains a string S of length $n (S_i \in \{`R', `B'\})$, indicating the vote choices of the cities. If the i-th city votes for the Red Party, $S_i = `R'$. Otherwise, $S_i = `B'$.

It's guaranteed that the sum of n of all test cases will not exceed $2 * 10^5$.

Output

For each test case output one line, containing the maximum number of votes the Red Party can get in the optimal division.

Example

standard input	standard output
3 5 RBRBR 5 RBBBR 4 RBRB	5 2 3

Note

For the first example, the best strategy is dividing all the cities into one state.

For the third example, the best division is [RBR|B], which makes the red Party gets 3 votes in the first state.

Problem E. Oscar and Right Triangle

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Oscar is a student in the Sakuya Primary School. Today, she is taking a math class of right triangles.

A right triangle is a triangle with an angle of 90 degrees. Moreover, if we have three sticks of positive length $a, b, c > 0$ satisfying that $a^2 + b^2 = c^2$, these three sticks can form a right triangle.

Oscar is a very creative girl. In her fantasy world, not only $a^2 + b^2 = c^2$, but also $a^2 + b^2 = 2c^2$ and $a^2 + b^2 = 3c^2$ are also the condition of forming a right triangle.

Now she wants you to calculate the number of positive integer pairs $(a, b)(a \leq b)$ that they can form a right triangle with c in Oscar's definition.

Input

There are multiple cases in this problem.

In the first line, there is an integer $T(T \leq 5)$, incitating the number of cases.

For each case, there is one integer $c(1 \leq c \leq 10^9)$ in one line.

Output

For each case, output an integer in one line, indicating the number of pairs (a, b).

Example

standard input	standard output
2 5 91353	3 3

}e18

$\cancel{a+b>c}$ $\cancel{a+b}$

$a^2+b^2=3c^2$

$\cancel{100}$ b

$b+c>a$

Problem F. Oscar and Permutation

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Oscar has a permutation of $1, 2, \cdots, n$, indicated by $P_0 = [p_1, p_2, \cdots, p_n]$. A shift operation on a permutation is moving the last element to the beginning of the permutation. For example, the permutation $[1, 2, 3]$ becomes $[3, 1, 2]$ after shifted once. Oscar shifts the permutation P_0 for continuous $n - 1$ times. Let $P_i (1 \le i \le n-1)$ denote the permutation after i operations. Oscar wants to know the $K-th$ smallest one among $P_0, P_1, \cdots, P_{n-1}$.

The comparison between two permutations is similar to alphabetical order. Given two different permutations $a = [a_1, a_2, \cdots, a_n]$ and $b = [b_1, b_2, \cdots, b_n]$, we need to find a d that $a_i = b_i$ for each $1 \le i < d$ and $a_d \ne b_d$. If $a_d < b_d$, we have $a < b$. Otherwise, we have $a > b$. For example, $[1, \underline{3}, 2] > [1, \underline{2}, 3]$ because $3 > 2$. $[\underline{3}, 2, 1] > [\underline{1}, 3, 2]$ because $3 > 1$.

Input

There are multiple test cases. The first line of the input contains an integer $T (1 \le T \le 10000)$, indicating the number of test cases. For each test case:

The first line contains two integers $n, K (1 \le K \le n \le 10^5)$, indicating the length of the permutation and the index of the permutation we want to know.

The second line contains n integers $p_1, p_2, \cdots, p_n (1 \le p_i \le n, p_i \ne p_j \text{ if } i \ne j)$, indicating the elements in the permutation P_0.

It's guaranteed that the sum of n over all the test cases doesn't exceed 10^6.

Output

For each test case output one line, containing the $K-th$ smallest permutation among $P_0, P_1, \cdots, P_{n-1}$, separated by spaces.

Example

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

Note

For the first example, $P_0 = [3, 2, 1], P_1 = [1, 3, 2], P_2 = [2, 1, 3]$. After sorting, we have $[1, 3, 2] < [2, 1, 3] < [3, 2, 1]$, so the $K-th$ smallest one among them is $[1, 3, 2]$.

Problem G. Oscar and Connect Function

Input file:	standard input
Output file:	standard output
Time limit:	2 seconds
Memory limit:	256 megabytes

Oscar just learned Graph Theory, and she thinks of a problem.

There is a undirected graph G of n nodes and m edges initially, the i-th node of which has a value of a_i. The connect function between two node sets S_1 and S_2 is defined as $f(S_1, S_2) = \sum_{i \in S_1, j \in S_2} a_i * a_j$. The connect function of the graph $f(G)$ is defined as the maximum connect function between the node sets of two different connected components. If there is no two different connected components in the graph, $f(G) = -1$.

The m edges are removed in some order. After each remove operation, Oscar want you to output $f(G)$ in the new graph.

Input

The first line of the input contains two integers n and $m (1 \le n \le 10^5, 1 \le m \le 3 * 10^5)$, indicating the number of nodes and edges in the graph.

The second line contains n integers $a_1, a_2, \cdots, a_n (1 \le a_i \le 3 * 10^4)$, indicating the values of the nodes.

The next m lines describe the edges in the graph. The i-th line contains two integers u_i and $v_i (1 \le u_i, v_i \le n)$, indicating that the i-th edge connects nodes u_i and v_i.

The next line contains m integers $p_1, p_2, \cdots, p_m (1 \le p_i \le m)$, indicating the order of removing the edges: the i-th remove operation removes the p_i-th edge in the graph. It's guaranteed that $p_1, p_2, \cdots, p_m$ is a permutation of $1, 2, \cdots, m$.

Output

Output m lines, the i-th line contains the connect function of the graph after the first i remove operations.

Examples

standard input	standard output
2 1 5 6 1 2 1	30
n m 5 4 ai 5 4 3 2 1 m边 1 2 1 2 3 2 3 4 3 4 5 4 remove 1 2 3 4	50 30 20 20

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Problem H. Oscar and Beautiful Sequence

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

For a non-negative sequence $a_1, a_2, ..., a_n$ of length n, Oscar thinks it is beautiful if and only if it satisfies $a_i \le a_{i+1}$ for each $1 \le i < n$. Now we want you to compute the number of beautiful sequence of length n that $\sum_{i=1}^{n} a_i = S$. Since the answer may be large, you only have to output the answer modulo 998244353.

Input

There are two integers $n, S (1 \le n \le 1000, 0 \le S \le 3000)$ in one line.

Output

Output the answer modulo 998244353 in one line.

Examples

standard input	standard output
1 1	1
5 20	192

Problem I. Oscar and Longest Common Subsequence

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Oscar just learned the concept of Longest Common Subsequence(LCS) between two strings a and b. We say x is a subsequence of y if y can be transformed into x by only removing some characters. if p is a subsequence of both a and b, we say it is a common subsequence of a and b. The Longest Common Subsequence(LCS) is the p of the longest length.

Now Oscar wants to consider LCS on two strings which keep changing. Specifically, in a string s, for each position i we have a shifting parameter k_i, indicating there will be k_i times of shifting in position i each moment. A shifting means the alphabet character will change to the following alphabet character. For example, $a \to b$, $b \to c \cdots$. Specially, z will becomes a and start another loop.

Now we have q queries in total. Each query comes with an integer t. We want you to compute the length of LCS of a and b at moment t.

Input

There are two integers $n, m (1 \leq n, m \leq 1000)$ in the first line, indicating the length of a and b respectively.

In the second line, there is an string of length n, indicating the string a.

In the third line, there is an string of lenght m, indicating the string b.

In the fourth line, there are n integers $k_{a,i} (0 \leq k_{a,i} \leq 25)$, indicating the shifting parameter of a.

In the fifth line, there are m integers $k_{b,i} (0 \leq k_{b,i} \leq 25)$, indicating the shifting parameter of b.

In the sixth line, there is only one integer $q (1 \leq q \leq 10^6)$, indicating the number of queries.

In the following q lines, there is only one integer $t_i (0 \leq t_i \leq 10^{18})$ in each line, indicating the moment we query about.

Output

Output the answer in one line for each query.

Example

standard input	standard output

`4 5`
`abac`
`abaac`
`1 2 1 7`
`1 3 2 1 7`
`2`
`0`
`1`
	`4`
	`3`

Note

a becomes 'bdbj' and b becomes 'becbj' at moment 1. The longest common subsequence of them is 'bbj'.

Problem J. Oscar and Lamp

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Oscar has a lamp in her room. Initially, the lamp is switched off. Oscar wants to light it up. However, the switch of the lamp is in another room and he must go there to press the switch.

The switch doesn't work very well. When it's pressed, it has a probability of $\frac{p}{10000}$ to flip the state of the lamp(on to off, or off to on). Oscar can press the switch multiple times, but she doesn't know whether the lamp is on until he goes back to his room. She wants to maximize the probability of the lamp being on when she goes back to his room. Can you help her?

Input

There are multiple test cases. The first line of the input contains an integer $T(1 \leq T \leq 100000)$, indicating the number of test cases. For each test case:

The first line contains an integer $p(0 \leq p \leq 10000)$, and the probability of switching the state of the lamp when the switch is pressed is $\frac{p}{10000}$.

Output

For each test case, output one line containing the probability of turning the lamp on if Oscar takes the optimal strategy.

Your answer will be considered correct if the absolute error or the relative error is less than 10^{-6}.

Example

standard input	standard output
3 10000 5000 0	1.0000000000 0.5000000000 0.0000000000

Problem K. Oscar and Tree Counting

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Oscar loves solving counting problems. Now she wants you to calculate the number of different trees satisfying the following condition:

1.There are n nodes in total, numbered from 1 to n.

2.Node 1 connects to at most 2 other nodes, while each other nodes connect to at most 3 other nodes.

3.The maximum matching on this tree is k.

The maximum matching is equal to the maximum number of chosen edges that no two edges share common endpoints.

Two trees are considered different if and only if there exist two nodes u, v, the edge (u, v) exists in only one of them.

Since the answer may be large, you only need to output the answer modulo $10^9 + 7$.

Input

The input contains two integers $n, k (2 \le n \le 50, 1 \le k \le n - 1)$ in one line, indicating the number of nodes and the value of maximum matching.

Output

Output the answer modulo $10^9 + 7$ in one line.

Example

standard input	standard output
4 2	12

Problem L. Oscar and Warriors

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	256 megabytes

Oscar is playing a game called Warriors. In the game, she has an army of n warriors numbered from 1 to n.

Now Oscar wants to run a fighting tournament in her army. Each time, she will randomly select 2 warriors and let them fight. Each warrior has the same possibility of being selected and they all have $\frac{1}{2}$ chances to win in the fight. The warrior who loses the fight will be eliminated from the tournament and the winner continues playing. The tournament ends when there is only one warrior remains, and he becomes the champion.

We can see that the champion will be decided after $n-1$ games. Now we want to know the expected value of the champion's number.

Input

The input contains one integer $n(1 \le n \le 10^{18})$ in one line, indicating the number of warriors.

Output

Please output the answer in the form of a/b that a and b are relatively prime, indicating the expected value of the champion's number.

Examples

standard input	standard output
1	1/1
2	3/2

Problem M. Prime Year

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Oscar loves prime numbers and he thinks those years whose number is a prime are prime years. For example, 2017 is a prime year. Note that a prime number means it can only be divided by 1 and itself.

Now Oscar wants to know the first prime year since 2020.

Input

There is no input.

Output

Please output the first prime year since 2020 in one line.