Problem A. Theramore

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	128 megabytes

–Those blood-soaked shores of Kalimdor is like a ghost haunting Jaina Proudmoore ever since the day she pushed her father into hell.

–Now, standing in front of the devastated ruins of Theramore, she knew how naive she had been to want peace.

–The Focusing Iris. It was the most brutal and cowardly killing method Jaina could imagine.

–The Horde wants war. They will do anything to destroy us. But if this is all they want, Jaina will be pleased to offer them a big one.

The warships of the Horde can be described as a string s which contains only '0' and '1', denoting the small warship and the large warship. Jaina can perform some magic to the string. In one magic, she chooses an arbitrary interval with odd length and reverse it. Jaina can perform this magic as many times as she likes.

Jaina wants the small warships to be in the front, since they are easier to destroy. She asks for your help, and you need to tell her the lexicographically smallest string that she can obtain.

Note: in this problem, suppose two sequences s and t both have length n, then s is lexicographically smaller than t if there exists a position $i(1 \leq i \leq n)$ such that $s_i = t_i$ for all $1 \leq j < i$ and $s_j =' 0', t_j =' 1'$.

Input

The input consists of multiple test cases.

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

Each test case consists of only one line containing a string s $(|s| \leq 10^5)$.

Output

Output one line containing the lexicographically smallest string that you can get.

Example

standard input	standard output
2 101001 01101100000000101010	001011 00000000001010101111

Problem B. Darkmoon Faire

Input file:	standard input
Output file:	standard output
Time limit:	4 seconds
Memory limit:	512 megabytes

–Ahead of You, Down the Path

–A Majestic, Magical Faire!

–Ignore the Darkened, Eerie Woods

–Ignore the Eyes That Blink and Stare

–Fun & Games & Wondrous Sights!

–Music & Fireworks to Light Up the Night!

–Do Not Stop! You're Nearly There!

–Behold, My Friend: THE DARKMOON FAIRE!

One day, you go to the Darkmoon Faire with your friends.

You begin to play a game called "Finding the Ridiculous Partitions"!

An array is "ridiculous if the maximum element of the array lies on an odd index, while the minimum element of the array lies on an even index.

You are given a sequence a of length n. It's guaranteed that all a_i are pairwise distinct.

You can partition the sequence into several (probably one) continuous intervals, such that the intervals don't intersect and that every position belongs to exactly one interval. For every interval, we can view it as a one-based array. A partition is "ridiculous if for each of the intervals, its corresponding array is ridiculous.

Please calculate the number of "ridiculous partitions"of the given sequence.

Since the answer can be very large, you only need to output the answer modulo 998244353.

Input

The input consists of multiple test cases.

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

For each test case, the first line contains a single integer n ($1 \le n \le 3 \times 10^5$).

The second line contains n integers a_i ($1 \le a_i \le 10^9$), it's guaranteed that $a_i \neq a_j$ for all $i \neq j$.

The sum of n over all test cases does not exceed 10^6.

Output

For each test case, output one line containing the answer modulo 998244353.

Example

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

Problem C. Undercity

Input file:	`standard input`
Output file:	`standard output`
Time limit:	15 seconds
Memory limit:	512 megabytes

–How many times have you died in WarCraft because of falling off the UnderCity's elevator?

–How many times have you traveled through the labyrinthine city but couldn't find the auction house?

–Undercity is a maze itself!

Undercity's map can be seen as an $n \cdot m$ matrix, each cell of the matrix contains a lowercase English letter. A path is a sequence of cells such that two neighbouring cells share one edge and the next cell can be reached from the previous cell by only moving **right or down**.

The city is a little bit weird, so one can only travel through a palindromic path.

A palindromic path is a path such that if you view the letters on all the cells from the starting point to the ending point of the path as a sequence, the sequence is equal when you read from left to right and from right to left.

A way of covering is considered magic if and only if all cells of the matrix are covered by **exactly one** palindromic path.

Two magic coverings are considered different if and only if there is **at least one** cell that is covered by different paths in two ways.

Sylvanas believes it's a fulfilling mission to find the number of magic coverings in the city.

Let's help her to do it!

Input

The input consists of multiple test cases.

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

In each test case, the first line contains two integers $n, m (n, m \leq 6)$, denoting the size of matrix.

The following n lines, each line contains m lowercase English letters, describing the matrix.

Output

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

Example

standard input	standard output
2 2 2 ab cd 2 2 aa aa	1 9

Problem D. Quel'Thalas

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

–Desperate magic addiction once made us miserable. Territory occupied by natural disasters made us wandering. But the misery should be put behind and we shall enter a new chapter.

–Us the same blood flows,we will bring back the glory of the sun again!

—-Salama ashal'anore!

Kael'thas has a magic square which contains all points on the 2D plane whose coordinates are integers within $[0, n]$.

He can draw several straight fire lines on the plane. Each line will cover all the points on it. Note that the lines have no endpoints and extend to infinity in both directions.

And there is one special rule: he cannot draw a line that covers the point $(0, 0)$ because his throne is on $(0, 0)$.

What is the minimum number of lines he needs to draw so that the lines will cover all the points of the magic square except $(0, 0)$?

Input

The input consists of multiple test cases.

The first line contains one integer T ($1 \leq T \leq 50$) denoting the number of test cases.

The following are T test cases.

Each test case consists of one line containing one integer n ($0 \leq n \leq 50$).

Output

For each test case, output one line containing one integer indicating the answer.

Example

standard input	standard output
1 2	4

Note

One possible answer for the sample is: x = 1, x = 2, y = 1, y = 2.

Problem E. Ironforge

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

–A finer blade has never been crafted by my hand. I only hope it does not come too late... A gryphon rider brought word to me only moments ago... ...King Terenas is dead, lads. Killed by Arthas' own hand. You have my condolences. And though they won't bring back your king... Perhaps this blade will administer some justice, return some semblance o' order to the turmoil that grips your kingdom. Terenas was a good man, wise and just. Know that the dwarves o' Ironforge will mourn his passing.

–<Birth of Ashbringer>

The subway of Ironforge can been seen as a chain of $n \geq 2$ vertices. In other words, for each $i = 1, 2, 3...n-1$, there is an edge between vertex i and vertex $i+1$.

There is a number $a_i (1 \leq i \leq n)$ on vertex i and a prime number $b_i (1 \leq i < n)$ written on the edge between vertex i and vertex $i+1$.

You may start a trip on some vertex with an empty bag. When you are on vertex i, you can put all prime factors of a_i into your bag. You can walk through an edge with prime number p written on it if and only if you already have p in your bag. You are allowed to pass each vertex and each edge **multiple times**.

You need to answer m queries. In each query you are given two numbers x, y. You need to answer whether you can reach vertex y if you start your trip on vertex x by the subway of Ironforge.

Input

The input consists of multiple test cases.

The first line contains an integer T $(1 \leq T \leq 3)$ denoting the number of test cases.

For each test case, the first line contains two integers n and m $(2 \leq n, m \leq 2 \times 10^5)$, denoting the number of vertices and the number of queries.

The second line contains n integers a_i $(1 \leq i \leq n, 1 \leq a_i \leq 2 \times 10^5)$.

The third line contains $n-1$ integers b_i $(1 \leq i < n, 2 \leq b_i \leq 2 \times 10^5)$.

Following m lines describe the queries. Each line contains two integers x, y $(1 \leq x, y \leq n)$.

Output

For each query, output one line containing "Yes"if its possible to reach vertex y from vertex x and "No"otherwise.

Example

standard input	standard output
1 5 5 7 1 6 6 14 7 2 3 2 1 2 1 4 3 5 5 1 3 1	Yes No Yes Yes Yes

Problem F. Thunder Bluff

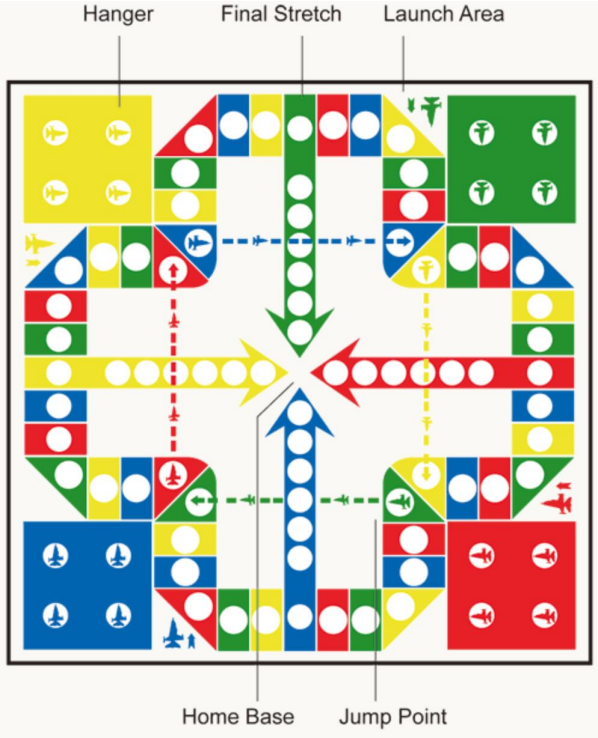
Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	512 megabytes

–*"Thunder Bluff is a beautiful and peaceful pla...."*

–*"I know! Now,let's play Airplane chess!"*

–*"What?"*

The board for the game is given in the picture below:



The game consists of four players, with each controlling one set of 4 pieces in the color of yellow, green, red and blue representing the airplanes. Initially, four pieces are placed facing up in the *Hanger* area of the respective color.

Starting with yellow, the players take turns to roll a dice in the order yellow, green, red and blue and. The rules are as follows(The *Hanger*/*Launch Area*/*Final Stretch*/*Jump Point*/*Home base*/ refer to the picture markings):

1. **Action rule:** Player can move one piece outside *Hanger* for x steps if the dice faced up with number x, or move one piece from *Hanger* to *Launch* if $x = 6$. If all four pieces are in *Hanger* and $x \neq 6$, the round is skipped.Starting from the *Launch* area, pieces move **clockwise** around the board, until reaching *Final Stretch* where the **Final stretch rule** is applied.

2. **Final stretch rule:** When a player's piece has reached the *Final Stretch* of its own color the piece, the direction will change towards its home base. If one piece will land exactly on the innermost grid of the *Final Stretch*, it will return *Hanger* facing down as the mark of completion. If the dice roll value is too large to land exactly on the innermost grid, it must continue the remaining steps backward along the final stretch.

3. **Stopping time:** The first player to have all four pieces facing down in the *Hanger* wins and the game ends.

4. **Pity rule:** In order to spice the game up, the pity rule is applied: if one skipped for consecutive 10

rounds, one piece will move into the launch area after skipping the 10-th round. Note that this piece in *Launch* can always move in the next round, and therefore the skipping streak will always be terminated by the pity rule, which means after *Launch*, the streak will become 0.

5. **Bonus round rule:** The player rolled a 6 will receive a *bonus turn*. After taking an action according to the Action rule, it will play an extra *bonus turn*. A player can receive another *bonus turn* in the previous *bonus turn* – with good enough luck, one can play infinite bonus turns until the game ends.

6. **Combo rule:** When one piece is going to land on a grid of its own color outside the *Final Stretch*, a *combo* will occur and move the piece four steps forward, and land on the next grid of the same color. The *combo* can not cause another *combo* in one round.

7. **Shortcut rule:** When one piece is going to land on a jump point of its own color, the player jumps by following the *shortcut* (indicated by the dotted line) to the grid across the board. Note that only one *combo* will happen in one *shortcut* journey: the piece will stay at the end of the *shortcut* if one *combo* happens before the *shortcut*, otherwise a *combo* will occur after the *shortcut*.

8. **Stacking rule:** After the settlement of *combo* and *shortcut*, one piece lands on a grid outside *Launch* area that already has some pieces of the same color, then those pieces will *stack* together. Pieces that are stacked will then **move together as one unit**.

9. **Proctect rule:** A piece is **protected** on the *Final Stretch* of its own color (including the outermost grid).

10. **Battle rule:** After the settlement of *combo* and *shortcut*, one piece lands on a grid with some opponent's pieces after one move, a battle occurs unless one side is **protected**. When a pieces of player A(ttacker) are arriving on this grid and d pieces of player D(efender) is on this grid originally, then $\min(a, d-1)$ pieces of player A and $\min(a, d)$ pieces of player D will be shot down and sent back to there respective hangers facing up.

In addition, a scoring system is included in this game according to the following rules:

1. Initially each player has 0 points. 2. When a player's piece reaches its home base, it receives $5x$ points (x is the number of pieces of other players that **haven't reached** the home base). 3. When some pieces of player A and B have a fight, where A is the **attacker** and B is the **defender**, if a pieces of player A and b pieces of player B are shot down and sent back to the hangers, then A receives $5b$ points and B receives $2a$ points. 4. For each player, if it rolls the number x for a consecutive y times, it receives $(6-x)*(y-1)^2$ points. Here only the **maximal consecutive identical rolls** are rewarded with points. Formally, suppose a player rolls x on its $i^{th}, (i+1)^{th}...(i+k)^{th}$ roll, then it receives $(6-x)*k^2$ points if and only if : 1. $i=1$ or the $(i-1)^{th}$ roll is not x 2. the $(i+k+1)^{th}$ roll does not exist (the game ends before it) or the $(i+k+1)^{th}$ roll is not x. 5. The winner receives an additional 50 points.

Now Alice, Bob, Carol and David are playing this game. Their colors are yellow, green, red and blue respectively. The players have one thing in common: if they roll 6 and have pieces facing up in the hanger, they will choose to launch a piece instead of moving the pieces out of the hanger. Beside that, if there are multiple choices of moves, each player has its own strategies:

Alice will always choose the move that **maximizes the number of stacked pieces** (that is, maximize the number of pieces belonging to Alice on the starting grid and landing grid, disregarding the possible fights after the move). If there are still multiple choices, Alice will choose to move the piece(s) closest to the home base.

Bob is aggressive and eager to have a fight with other players, thus he will always choose the move that gets **the maximum score** by shooting down other players' pieces. If there are still multiple choices, Bob will choose to move the piece(s) closest to the home base.

Carol wants his pieces to travel as fast as possible, so he will always choose the move that **maximizes the distance of grids** between the starting grid and the landing grid, which can be **negative or zero** in some special cases. If there are still multiple choices, Carol will choose to move the piece(s) closest to the home base.

David doesn't want any complex strategies and will always choose to move the piece(s) **closest to the**

launch area(that is, the maximum distance between the current grid and the home base).

Here we define **closest to the home base** as having the minimum number of grids between the current grid and the respective home base, disregarding jumps.

Now you are given the result of each dice roll, you should predict the winner of the game and the final score of each player.

In order to avoid huge input, you are given four secret parameters x, y, z, w and the result of each dice roll is generated by the following code:

```
uint32_t x, y, z, w;
uint32_t Xor128() {
        uint32_t t;
        t = x ^ (x << 11);
        x = y; y = z; z = w;
        return w = w ^ (w >> 19) ^ (t ^ (t >> 8));

}
int GetDice() {
        return Xor128() % 6 + 1;
}
```

CAUTION: There is some difference between the rules described in this problem and the rules of the Airplane Chess in the human world, so please read the rules above carefully.

Input

The input consists of multiple test cases.

The first line contains one integer T ($1 \leq T \leq 50$) denoting the number of test cases.

Each test case consists of one line containing four integers x, y, z, w ($0 \leq x, y, z, w \leq 2^{32} - 1$).

It's guaranteed that according to the rule and data, the game will ends in finite rounds.

Output

For each test case, output five lines:

The first line displays the winner, in the form "NAME win!". ("NAME"is replace by "Alice "Bob "Carol "David").

The next four lines display the final score of each player, in the form "NAME: score sorted by the score from large to small. If there are two players whose score are equal, output the player whose name has smaller lexicographical order first.

See the Sample Output for better understanding.

Example

standard input	standard output
1 1 1 1 1	Bob win! Bob: 269 Alice: 213 Carol: 118 David: 99

Problem G. Darnassus

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

Even the World Tree must bow to the cycle of life. Everything born will die.

Archimonde has hurt it once, Sylvanas burnt it again.

Now the World Tree is slowly recovering.

The World Tree is burnt apart into n parts. Now it tries to rebuild itself.

Each part of the World Tree has an attribute p_i, and all p_i $(1 \le i \le n)$ forms a permutation of $1, 2, 3...n$.

For all $1 \le i < j \le n$, if the World Tree wants to grow an edge connecting part i and part j directly, it needs to spend $|i - j| \cdot |p_i - p_j|$ energy. $|x|$ means the absolute value of x.

The World Tree is very smart, so it will grow some edges such that all its n parts become connected (in other words, you can go from any part to any other part using only the edges that have been grown), spending the minimum energy.

Please calculate the minimum energy the World Tree needs to spend.

Input

The input consists of multiple test cases.

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

For each test case, the first line contains a single integer $n(1 \le n \le 50000)$.

The second line contains n integers p_i $(1 \le p_i \le n)$, it's guaranteed that all p_i forms a permutation.

Output

For each test case, output one line containing one integer indicating the answer.

Example

standard input	standard output
2 5 4 3 5 1 2 10 4 7 3 8 6 1 9 10 5 2	7 24

Problem H. Orgrimmar

Input file:	`standard input`
Output file:	`standard output`
Time limit:	10 seconds
Memory limit:	1024 megabytes

"In my memory, the last time such a tragic farewell to a respected Horde leader was at the top of Thunder Bluff. That day, Mother Earth was crying for him too. "

"This time, it is the Shadow of the Horde who has left us. At this moment, the entire Horde is whispering affectionately for him. "

"Son of Sen'jin, leader of the Darkspear tribe, Warchief of the Horde - Vol'jin."

Born in the cunning and vicious troll race, he spent his life explaining to the world what loyalty and faith are.

A dissociation set of an undirected graph is a set of vertices such that if we keep only the edges between these vertices, each vertex in the set is connected to at most one edge.

The size of a dissociation set is defined by the size of the set of vertices.

The maximal dissociation set of the graph is defined by the dissociation set of the graph with the maximum size.

Sylvanas has a connected undirected graph that has n vertex and $n-1$ edges, and she wants to find the size of the maximal dissociation set of the graph.

But since she just became the warchief of the Horde, she is too busy to solve the problem.

Please help her to do so.

Input

The input consists of multiple test cases.

The first line contains one integer T ($1 \leq T \leq 10$) denoting the number of test cases.

The following are T test cases.

For each test case, the first line contains one integer n ($n \leq 500000$), which is the number of vertexes.

The following $n-1$ lines each contains two integers x and y denoting an edge between x and y.

It is guaranteed that the graph is connected.

Output

For each test case, output one line containing one integer indicating the answer.

Notes:

–In this problem, you may need more stack space to pass this problem.

–We suggest you to add the following code into your main function if you use C++.

```
int main() {
    int size(512<<20);  // 512M
    __asm__ ( "movq %0, %%rsp\n"::"r"((char*)malloc(size)+size));
    // YOUR CODE
   ...
    exit(0);
}
```

And if you use the code above please DON'T forget to add $exit(0)$; in the end of your main function, otherwise your code may get RE.

Example

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

Problem I. Gilneas

Input file:	`standard input`
Output file:	`standard output`
Time limit:	10 seconds
Memory limit:	512 megabytes

Standing, Genn watched the sunlight flicker on the calm ocean. His whole body hurt, but his mind was clearer than it had been in weeks. He waited a moment, certain that his thoughts would soon become filled with memories he'd rather forget. But none haunted him now. The ships were separating from the flotilla. Now, with the trouble averted, each unraveled its own bright sail and glided out farther over the sun-speckled sea.

"You said to me that this Archdruid Stormrage believes my people will be an important asset to the Alliance."

"That I did."

"Perhaps he is right, then.... Perhaps he is right."

Genn has a tree with n vertices, **rooted** at vertex 1. As a master of data structure, he performs m "access"operations to the tree in chronological order. For the i^{th} operation, vertex x_i will be "accessed": all edges on the **route** from vertex x_i to the root will be painted color c_i. Meanwhile, the color of all other edges that have **exactly one** common vertex with the route will be reset to 0.

The value of the tree is defined as the sum of color on all edges after all operations are performed.

Unfortunately, painting on trees is really a dangerous task, so each operation has only p_i probability to be performed successfully, and for probability $1 - p_i$ the operation will be skipped and nothing will happen to the tree.

Genn wants to know the expected value of the tree **modulo** $10^9 + 7$.

Formally, let $M = 10^9 + 7$. It can be demonstrated that the answer can be presented as a irreducible fraction $\frac{p}{q}$, where p and q are integers and $q \not\equiv 0 \pmod{M}$. Output a single integer equal to $p \cdot q^{-1} \bmod M$. In other words, output an integer x such that $0 \le x < M$ and $x \cdot q \equiv p \pmod{M}$.

Input

The input consists of multiple test cases.

The first line contains an integer $T(1 \le T \le 4)$ denoting the number of test cases.

For each test case, the first line contains two integers n and m $(1 \le n, m \le 2 \times 10^5)$, denoting the number of vertices and the number of operations.

The second line contains $n - 1$ integers $f_2, f_3 ... f_n (1 \le f_i \le i - 1)$, f_i is the parent of vertex i.

Following m lines describe the operations. Each line contains three integers $x_i, c_i, p_i (1 \le x_i \le n, 1 \le c_i, p_i < 10^9 + 7)$. Note that p_i ought to be a fraction $\in [0, 1]$ but is given in the special form described above.

Output

For each test case, output one line containing one integer indicating the answer.

Example

standard input	standard output
2 5 3 1 1 3 3 2 1 500000004 4 2 500000004 5 3 500000004 10 10 1 2 2 3 2 5 4 8 2 10 8042252 94637128 1 561941603 324991490 3 752444595 585213411 5 210303898 641078478 6 693964040 699726787 9 882181410 70805620 7 950609757 940002046 4 478347490 231203984 8 152593189 752354400 2 557926271 296109563	125000005 34778673

Problem J. Vale of Eternal

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

To ask why we fight?

Is to ask why the leaves fall?

It is in the nature.

Perhaps there is a better question.

Why do we fight?

To protect home and family,

To preserve balance and bring harmony.

For my kind,

The true question is what is worth fighting for.

–CG<Mists of Pandaria>

Chen is practicing Kungfu. He uses Chi Burst to make energy points split.

Initially, there are n energy points on the infinite 2D plane, in every second, every energy point will check its four neighbouring positions (up $(0,1)$, down $(0,-1)$, left $(-1,0)$, right $(1,0)$) If there is no energy point at that position, a new energy point will be generated at that position.

Chen would like to know the progress of the practice in advance. He will give you q queries, each query consists of a single integer t, and you need to find the area of the convex polygon constructed by all energy points after t seconds.

Input

The first line contains a single integer $T(1 \leq T \leq 11)$, denoting the number of test cases. In each test case, the first line contains two integers $n, q(1 \leq n, q \leq 2 * 10^5)$, denoting the number of points initially and the number of queries.

The following n lines, the i-th line contains two integers $x, y(0 \leq x, y \leq 10^8)$, denoting the coordinate of the i-th initial energy point.

Then following q lines, each line contain one integer $t(0 \leq t \leq 10^8)$, denoting the number of seconds.

It's guaranteed that $\sum n \leq 5 * 10^5, \sum q \leq 5 * 10^5$.

Output

For each query, output a single line, denoting the answer, your answer should be rounded to one decimal place.

Example

standard input	standard output
2 3 3 2 3 4 3 1 1 1 2 3 3 3 4 1 3 4 2 1 2 3 4	11.0 24.0 41.0 27.0 45.0 67.0

Problem K. Stormwind

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

–"So, people of Stormwind! Let us unite this day. Let us renew our promise to uphold and protect the Light, and together we will face down this dark new storm and stand firm against it—as humanity always has... and humanity always will!"

–The crowd saved its greatest roars for the end. A chorus of "Long live King Varian! Long live King Varian!"rose into the sky with vigor and conviction. The cheers were unending, echoing deep into Elwynn Forest and faintly reaching even the distant peaks of the Redridge Mountains.

Varian Wrynn gained a rectangular piece of gold in the battle, with length n and width m. Now he wants to draw some lines on the gold, so that later he can cut the gold along the lines.

The lines he draws should satisfy the following requirements:

1. The endpoints of the lines should be on the boundary of the gold.

2. The lines should be parallel to at least one boundary of the gold.

3. After cutting along all the lines, each piece of gold is a rectangle with integer length and width.

4. After cutting along all the lines, the area of each piece of gold should be at least k.

5. Two lines should not share more than one common points.

Varian Wrynn wants to cut the gold in such a way that maximizes the lines he draws.

As Alliance's Supreme King, he certainly doesn't have time to do this. So he finds you! Please help him to cut the gold!

Input

This problem contains multiple test cases.

The first line contains an integer T ($1 \le T \le 100$) indicating the number of test cases.

Each test case consists of one line containing three integers n, m, k ($1 \le n, m, k \le 10^5$). Its guaranteed that $n \times m \ge k$.

Output

For each test case, output one line containing one integer, the maximum number of lines you can draw.

Example

standard input	standard output
2 5 4 2 10 9 13	5 4

Note

In the first test case, Varian Wrynn can draw 4 lines parallel to the boundary of length 4 and 1 line parrallel to the boundary of length 5. After cutting along the lines, he can get 10 pieces of gold of size 2.

Problem L. The Dark Temple

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

–*"We do not all have to enter the darkness to fight against it."*

–*"Sometimes, defeating evil means getting your hands dirty."*

–*"And sometimes, getting your hands dirty turns you to evil."Ishanah's smile seemed mocking.*

–*"In order to work with the Light, you must be pure of heart."*

–*"And you think I am not?"Maiev's anger simmered in her voice.*

–*"I think you do what you believe is right."*

Illidan is practicing light magic now and he is trying to use holy light to make a good tree. And he wants the sum of the depth of each vertex in the tree to be a certain number.

A good tree is a rooted tree and each vertex of it is either a leaf or has two children.

The depth of a vertex is the length of the path to its root.

The "depth sequence"A of tree T, is an infinite sequence where $A[i] = f(T, i)$. $f(T, i)$ is the number of vertices in the tree T with depth i.

Given an integer k, you should determine whether there is a good tree T such that,

$$\sum_{i \geq 0} f(T, i) * i = k$$

If there is no such tree, output -1.

If there are more than one eligible trees, please output the one with the minimum number of vertices.

If there are still more than one eligible trees, please output the one with the lexicographically smallest depth sequence.

In this problem, for your convenience, you only need to output the depth sequence of the tree.

It can be proven that the output is uniquely determined.

Note: For two infinite sequences A and B, A is less than B in lexicographical order if and only if there exists $i \geq 0$ such that $A[i] < B[i]$, and $A[j] = B[j]$ for all $j = 0..i - 1$.

Input

The first line contains one integer T ($1 \leq T \leq 10$) denoting the number of test cases.

The following are T test cases.

Each test case consists of one line containing one integer k ($0 \leq k \leq 10^{12}$), which is the sum of depth of all vertices.

Output

For each test case, if there is no such tree, output one line containing -1.

Otherwise, output two lines.

The first line contains two numbers n and d indicating the number of vertices and the maximal depth of vertices in the tree.

The second line contains $d+1$ numbers indicating $A[0]..A[d]$ that is the positive part of the degree sequence A.

Example

standard input	standard output
2 4 22	-1 11 3 1 2 4 4

Problem M. Shattrath City

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

–*Why would a 'prophet' not warn of calamity?*

–*Why didn't you warn the world about the Cataclysm?* The simple, logical question of a mortal child echoed accusingly throughout the silent chamber, distracting the Prophet from his contemplation of the Light. Velen had evaded rather than answered, obscured instead of illuminating. He was surprised at himself. *Am I still capable of deception? Even after all this time? Both within and without?*

–*Velen is sinking in self-doubt.*

Velen calls a sequence "n-beautiful if it satisfies the following three conditions:

1. Its length is larger than n.

2. Each element of the sequence is a positive integer $\leq n$.

3. Each of its continuous subsequence of length n is **NOT** a permutation of $1, 2...n$.

Velen takes inspiration from "n-beautiful"sequences, so he is interested in the number of "n-beautiful"sequences of length m.

Could you help him?

Since the answer can be very large, you only need to output the answer **modulo 998244353**.

Input

This problem contains multiple test cases.

The first line contains an integer $T(1 \leq T \leq 4)$ indicating the number of test cases.

Each test case consists of only one line containing two integers n, m $(3 \leq n < m \leq 2 \times 10^5)$.

Output

For each test case, output one line containing one integer indicating the answer.

Example

standard input	standard output
3 3 5 5 10 100000 200000	123 8001745 700646201