

2017 Multi-University Training Contest by NJU

Problemset: A Star Wars Story

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Problem A Army Formations

“Stormtroopers were the assault/policing troops of the Galactic Empire. Dissenting citizens referred to them as bucketheads, a derogatory nickname inspired by the bucket-shaped helmets of stormtroopers. They wore white armor made from plastoid over a black body glove which, in addition to creating an imposing image, was outfitted with a wide array of survival equipment and temperature controls that allowed its wearer to survive in most environments, and were designed to disperse blaster bolt energy. As members of the Stormtrooper Corps, an independent branch that operated under the Imperial Army, stormtroopers represented the backbone of the Imperial Military—trained for total obedience to the command hierarchy, as well as absolute loyalty to Emperor Sheev Palpatine and the Imperial regime. Stormtroopers were trained at Imperial Academies, and used a variety of weapons.
— Wookieepedia”

Though being cruel and merciless in the battlefields, the total obedience to the command hierarchy makes message delivering between Stormtroopers quite inefficient, which finally caused the escape of Luke Skywalker, the destroy of the Death Star, and the collapse of the Galactic Empire.

In particular, the hierarchy of Stormtroopers is defined by a *binary tree*. Everyone in the tree has at most two direct subordinates and exactly one direct leader, except the first (numbered 1) Stormtrooper, who only obey the order of the Emperor.

It has been a time-consuming task for the Stormtroopers to input messages into his own log system. Suppose that the i -th Stormtrooper has a message of length a_i , which means that it costs a_i time to input this message into a log system. Everyone in the hierarchy has the mission of collecting all messages from his subordinates (a direct or indirect children in the tree) and input these messages and his own message into his own log system.

Everyone in the hierarchy wants to optimize the process of inputting. First of all, everyone collects the messages from all his subordinates. For a Stormtrooper, starting from time 0, choose a message and input it into the log system. This process proceeds until all messages from his subordinates and his own message have been input into the log system. If a message is input at time t , it will induce t units of penalty.

For every Stormtrooper in the tree, you should find the minimum penalty.

Input

The first line of the input contains an integer T , denoting the number of test cases.

In each case, there are a number n ($1 \leq n \leq 10^5$) in the first line, denoting the size of the tree.

The next line contains n integers, the i -th integer denotes a_i ($0 \leq a_i \leq 10^8$), the i -th Stormtrooper's message length.

The following $n - 1$ lines describe the edges of the tree. Each line contains two integers u, v ($1 \leq u, v \leq n$), denoting there is an edge connecting u and v .

Output

For each test case, output n space-separated integers in a line representing the answer. i -th number is the minimum penalty of gathering messages for i -th Stormtrooper.

Sample Input

```
1
3
1 2 3
1 2
2 3
```

Sample Output

```
10 7 3
```

Problem B Battlestation Operational

“*The Death Star, known officially as the DS-1 Orbital Battle Station, also known as the Death Star I, the First Death Star, Project Stardust internally, and simply the Ultimate Weapon in early development stages, was a moon-sized, deep-space mobile battle station constructed by the Galactic Empire. Designed to fire a single planet-destroying superlaser powered by massive kyber crystals, it was the pet project of the Emperor, Darth Vader, and its eventual commander Grand Moff Wilhuff Tarkin to expound the military philosophy of the aptly named Tarkin Doctrine.*

— Wookieepedia”

In the story of the Rogue One, the rebels risked their lives stolen the construction plan of the Death Star before it can cause catastrophic damage to the rebel base. According to the documents, the main weapon of the Death Star, the Superlaser, emits asymmetric energy in the battlefield that cause photons to annihilate and burns everything in a single shot.

You are assigned the task to estimate the damage of one shot of the Superlaser.

Assuming that the battlefield is an $n \times n$ grid. The energy field ignited by the Superlaser is asymmetric over the grid. For the cell at i -th row and j -th column, $\lceil i/j \rceil$ units of damage will be caused. Furthermore, due to the quantum effects, the energies in a cell cancel out if $\gcd(i, j) \neq 1$ or $i < j$.

The figure below illustrates the damage caused to each cell for $n = 100$. A cell in black indicates that this cell will not be damaged due to the quantum effects. Otherwise, different colors denote different units of damages.

Your should calculate the total damage to the battlefield. Formally, you should compute

$$f(n) = \sum_{i=1}^n \sum_{j=1}^i \left\lceil \frac{i}{j} \right\rceil [(i, j) = 1],$$

where $[(i, j) = 1]$ evaluates to be 1 if $\gcd(i, j) = 1$, otherwise 0.

Input

There are multiple test cases.

Each line of the input, there is an integer n ($1 \leq n \leq 10^6$), as described in the problem.

There are up to 10^4 test cases.

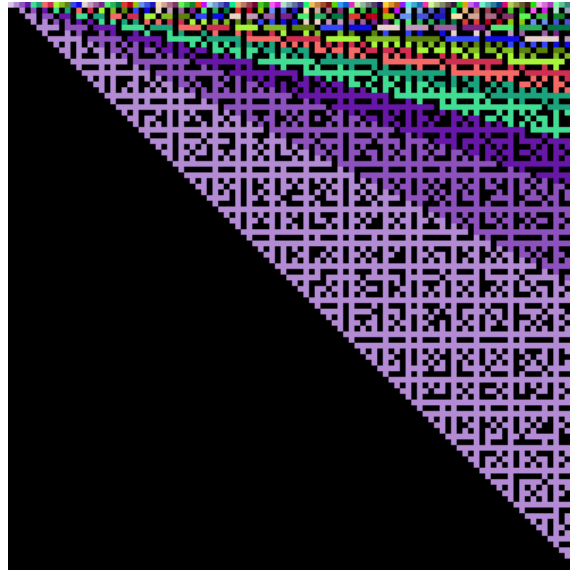


Figure 1: Illustration of the damage to the battlefield

Output

For each test case, output one integer in one line denoting the total damage of the Superlaser, $f(n)$.

Sample Input

```
1
2
3
10
```

Sample Output

```
1
3
8
110
```

Problem C Casual Podracing

“Podracing was a dangerous racing sport on planets such as Malastare, Theron, and Tatooine. Racers could perform multiple laps on a particular race track, moving at dangerous and, at times, deadly speeds. The races were performed using craft known as Podracers or pods, which were small, one-man craft propelled by large engines. Races could then be projected in entertainment establishments throughout the galaxy.
— Wookieepedia”

Anakin Skywalker is the only human known to compete in Podracing. To win this dangerous racing, in which the participant may lose his life, little Anakin has to practice with his friends under a much softer rule.

Participants have to compete in a circular track (L in length). At the beginning of the racing (time zero), all podracers are at distinct locations. The i -th podracer starts at location d_i ($0 \leq d_i < L$), then the Podracing starts. Since all Anakin's friends built their own podracers, they have distinct speeds. The speed of the i -th participant is v_i (the speed can either be positive or negative. A positive speed indicates a clockwise podracer and a negative speed indicates a counterclockwise podracer).

Furthermore, the i -th participant has a power of w_i . During the racing, participants may meet (being located at the same place at the same time). To better record the progress of the racing, Anakin decides to mark the participants whose powers are strictly less than the maximum power of the participants he ever met, indicating that they are a loser. Since they are just practicing, being marked does not mean the participant is out, he can continue competing and mark someone else with less power.

When no one can be marked, the racing terminates.

Find the terminal time of the racing.

Input

The first line of the input contains an integer T ($T \leq 20$), denoting the number of test cases.

For each test case, the first line contains two integers n, L ($1 \leq L \leq 10^6$).

The next line contains n distinct integers, denoting d_i ($0 \leq d_i < L$).

The next line contains n distinct integers, denoting v_i ($|v_i| \leq 10^6$).

The next line contains n integers, denoting w_i ($0 \leq w_i \leq n$).

The sum of n in all test cases won't be greater than 10^5 .

Output

For each test case, you should output the answer as a fraction that is reduced to lowest terms.

If the answer is 0, you should just output “0”.

Sample Input

```
1
8 8
2 1 5 7 4 6 0 3
86 27 -85 -8 11 73 -37 -69
0 6 4 4 3 0 2 5
```

Sample Output

```
4/61
```

Problem D Death Podracing

“During the Trade Federation invasion of Naboo, Anakin Skywalker won the Boonta Eve Classic on Tatooine, securing his freedom from a life of slavery. Betting on the races was a popular pastime with many of the watchers on Tatooine and it was through Qui-Gon Jinn’s bet with Watto that Skywalker would win the race that Skywalker was freed.
— Wookieepedia”

Here comes the most awesome racing in the universe! Little Anakin sits in his own podracer, breathing deeply. He must win.

The real podracing is deadly. In this circular track (again L in length), participants start in distinct locations and race with distinct speeds (the speed can be positive and minus, which means running clockwise and counterclockwise). Every podracer is equipped with a powerful weapon system respectively – all for triumphing over enemies!!! yes! enemies!

If two competitors meet, which means that they reach an identical location simultaneously, the one with less powerful weapon system will be destroyed and be knocked out of the racing – dead or alive. The power of the i -th participant is exactly i , and because each person runs with a distinct speed, so there must be a winner.

The racing stops when there is only one person still running in the track – our winner! The others are crushed into pieces.

Little Anakin wants to know, when the racing will stop.

Input

The first line contains an integer T ($T \leq 1000$), denoting the number of test cases.

For each test case, the first line contains two integers n ($2 \leq n \leq 10^5$) and L ($1 \leq L \leq 10^9$).

The following line contains n distinct integers d_1, d_2, \dots, d_n ($0 \leq d_i < L$), representing the starting points of the participants.

The next line contains n distinct integers v_1, v_2, \dots, v_n ($0 \leq |v_i| \leq 10^9$), representing the velocity of the participants.

The sum of all n in all test cases doesn’t exceed 2×10^6 .

Output

One line for each test case. You should output the answer that is reduced to lowest terms.

Sample Input

```
2
2 4
0 2
3 2
10 100
56 89 62 71 7 24 83 1 47 52
9 -16 34 -38 47 49 -32 17 39 -9
```

Sample Output

```
2/1
37/7
```

Problem E Engineering of the Clones

“Cloning was the process of creating a genetically identical or—purposefully and specifically—modified copy of an original organism. It was also one of the key factors that facilitated the end of the Galactic Republic and the dawn of the Galactic Empire in its place. Through the science of cloning, a vast clone army was created on Kamino for the purpose of serving the Republic. Programmed with absolute loyalty to Supreme Chancellor Palpatine, leader of the Galactic Senate and secretly the Sith Lord Darth Sidious, the clones proved to be instrumental in his rise to the position of Emperor. The military applications of cloning were further exploited by the New Order through the creation of countless more clone soldiers, all used mainly for the sole purpose of spreading and enforcing Imperial hegemony throughout the galaxy.
— Wookieepedia”

The clones are engineered such that all have exactly the same genetic footprint, and are flash-learned directly from a template. Thus, all clones should be completely identical to the original person in theory. However, the cloning procedure is proven to be defective. A clone may be physically deformed and will die in his early age, or even worse, a seemingly functional clone may also have tiny defects in the brain development that may leak secretly programmed information. During the Clone War, such a rare case was reported: a Jedi was killed by a malfunctioning clone believed that the Order 66 has been issued, and the case nearly lead to the Jedi Council to discover the secret plan of the evil Darth Sidious.

After the malfunctioning case was reported, Chancellor Palpatine decided to carefully test all clones before they are being delivered to the battlefield. This is done by a procedure called “high-precision genome fingerprinting” that balances the time and the money. In particular, the entire gnome of a clone is taken and encoded as a single number. Only one digit of that number is actually sampled and tested.

Given genes denoted by prime numbers p_1, p_2, \dots, p_n , the genome of the clone is represented by a number A defined as

$$A = p_1^{r_1} p_2^{r_2} \dots p_n^{r_n}$$

where

$$|r_i - r_j| \leq 1, 1 \leq i \leq j \leq n.$$

Since A may be huge in size, the test process only samples one digit as the fingerprint: the k -th digit of $\frac{1}{A-1}$ written in base $\prod_{i=1}^n p_i$.

You received the mission of designing an algorithm to perform the genome fingerprinting test. Given a genome description (p_i and r_i) and k , you should find the fingerprint value.

Input

The first line of the input contains an integer T , denoting the number of test cases.

For each test case, the first line contains two integers n ($1 \leq n \leq 10^6$) and k ($1 \leq k < \max\{r_1^2, r_2^2, \dots, r_n^2\}$).

The next line contains n distinct primes. The i -th number is p_i $1 \leq \prod_{i=1}^n p_i \leq 10^6$.

The next line contains n integers. The i -th number is r_i ($1 \leq r_i \leq 5 * 10^4$).

Sample Input

```
1
2 1
2 5
2 2
```

Sample Output

```
0
```

Problem F Fleet of the Eternal Throne

“*The Eternal Fleet was built many centuries ago before the time of Valkorion by an unknown race on the planet of Lokath. The fate of the Fleet’s builders is unknown but their legacy would live on. Its first known action was in the annihilation of all life in Wild Space. It spread across Wild Space and conquered almost every inhabited world within the region, including Zakuul. They were finally defeated by a mysterious vessel known as the Gravestone, a massive alien warship that countered the Eternal Fleet’s might. Outfitted with specialized weapons designed to take out multiple targets at once, the Gravestone destroyed whole sections of the fleet with a single shot. The Eternal Fleet was finally defeated over Zakuul, where it was deactivated and hidden away. The Gravestone landed in the swamps of Zakuul, where the crew scuttled it and hid it away.*

— Wookieepedia”

The major defeat of the Eternal Fleet is the connected defensive network. Though being effective in defending a large fleet, it finally led to a chain-reaction and was destroyed by the Gravestone. Therefore, when the next generation of Eternal Fleet is built, you are asked to check the risk of the chain reaction.

The battleships of the Eternal Fleet are placed on a 2D plane of n rows. Each row is an array of battleships. The type of a battleship is denoted by an English lowercase alphabet. In other words, each row can be treated as a string. Below lists a possible configuration of the Eternal Fleet.

```
aa
bbbbaaa
abbaababa
abba
```

If in the x -th row and the y -th row, there exists a consecutive segment of battleships that looks identical in both rows (i.e., a common substring of the x -th row and y -th row), at the same time the substring is a prefix of any other row (can be the x -th or the y -th row), the Eternal Fleet will have a risk of causing chain reaction.

Given a query (x, y) , you should find the longest substring that have a risk of causing chain reaction.

Input

The first line of the input contains an integer T , denoting the number of test cases.

For each test cases, the first line contains integer n ($n \leq 10^5$).

There are n lines following, each has a string consisting of lower case letters denoting the battleships in the row. The total length of the strings will not exceed 10^5 .

And an integer m ($1 \leq m \leq 100$) is following, representing the number of queries.

For each of the following m lines, there are two integers x, y , denoting the query.

Output

You should output the answers for the queries, one integer per line.

Sample Input

```
1
3
aaa
baaa
caaa
1
2 3
1 2
```

Sample Output

```
3
3
```

Problem G Galaxy at War

“A young Jedi named Darth Vader, who was a pupil of mine until he turned to evil, helped the Empire hunt down and destroy the Jedi Knights. He betrayed and murdered your father. Now the Jedi are all but extinct.”
— Obi-Wan Kenobi, to Luke Skywalker”

“The Jedi Purge was the period in which the Jedi Order was destroyed by the Sith and the Jedi were hunted by the Galactic Empire to near-extinction.”
— Wookieepedia”

In the Jedi Temple, the 501-st Legion headed by Darth Vader are having an intense battle with the Jedi. The Jedi Temple can be seen as an $n \times m$ matrix. There are Meditations that can enhance the force and pollutant sources from the dark side that weaken the force. There are some crystals in the Temple. Vader and Jedi master Yoda are playing a game, which is moving the crystals in turns.

Each turn, the player can choose a cell (x, y) with crystals. Suppose that there are w crystals in (x, y) , the player can pick up t ($1 \leq t \leq w$) crystals. If there is a Meditation in (x, y) , because of the amazing power of Meditation, the player can produce t extra crystals: he can place t crystals in $(x+1, y)$ and t crystals in $(x, y+1)$. Otherwise (there is no Meditation in (x, y)), the player can just place t crystals in $(x+1, y)$ or place t crystals in $(x, y+1)$.

However, if t crystals are put into a cell (x, y) where there is a pollutant source, $\lceil \frac{t}{2} \rceil$ crystals will be destroyed and only $\lfloor \frac{t}{2} \rfloor$ are saved.

Besides, there is a super pollutant source in (n, m) , and it will destroy all crystals put into (n, m) . To control this darkness, there is a Meditation in $(n-1, m)$.

In addition, there is a force field outside the Jedi Temple, which means that you can not move any crystals outside the matrix. That is to say:

- If you should put k crystals into $(x+1, y)$ and k crystals into $(x, y+1)$, but $(x+1, y)$ is outside the matrix, then you can only put $2k$ crystals into $(x, y+1)$. Similarly, you can only put $2k$ crystals into $(x+1, y)$ if $(x, y+1)$ is outside the matrix.
- If you can choose to put k crystals into $(x+1, y)$ or $(x, y+1)$ but one of them is outside the matrix, you can only put the crystals into the other one.

The one who cannot move any crystal will lose the game. Both Darth and Yoda are smart and will always choose the optimal strategy. Now, Vader is playing first, can he win the game and evade the Jedi Temple?

Because of the collision of Meditations and pollutant sources, for every pair of Meditations (x, y) and pollutant sources (a, b) ,

$$\max(|(x - a) + (y - b)|, |(x - y) - (a - b)|)$$

is constrained to be an odd number.

Input

The first line of the input contains an integer T , denoting the number of test cases.

For each test case, the first line contains two integers n, m ($1 \leq n, m \leq 10^3$).

The next line contains an integer k ($0 \leq k \leq 5 \times 10^5$), denoting the number of places containing crystals.

Each of the following k lines contains three integers x, y, w , representing that there are w ($1 \leq w \leq 10^9$) crystals in cell (x, y) .

The next line contains an integer t ($0 \leq t \leq 5 \times 10^5$).

Each of the following t lines contains two integer x, y , which means that there is a Meditation in (x, y) .

The next line contains an integer s ($0 \leq s \leq 5 \times 10^5$).

Each of the following s lines contains two integer x, y , which means that there is a pollutant sources in (x, y) .

All x and y satisfy $1 \leq x \leq n, 1 \leq y \leq m$.

Output

Output “win” if Vader can win the game, otherwise output “lose”.

Sample Input

```
1
2 2
1
1 1 1
1
1 2
1
2 2
```

Sample Output

```
lose
```

Problem H Hybrid Crystals

“Kyber crystals, also called the living crystal or simply the kyber, and known as kaiburr crystals in ancient times, were rare, Force-attuned crystals that grew in nature and were found on scattered planets across the galaxy. They were used by the Jedi and the Sith in the construction of their lightsabers. As part of Jedi training, younglings were sent to the Crystal Caves of the ice planet of Ilum to mine crystals in order to construct their own lightsabers. The crystal’s mix of unique lustre was called “the water of the kyber” by the Jedi. There were also larger, rarer crystals of great power and that, according to legends, were used at the heart of ancient superweapons by the Sith.

— Wookieepedia”

Powerful, the Kyber crystals are. Even more powerful, the Kyber crystals get combined together. Powered by the Kyber crystals, the main weapon of the Death Star is, having the firepower of thousands of Star Destroyers.

Combining Kyber crystals is not an easy task. The combination should have a specific level of energy to be stabilized. Your task is to develop a Droid program to combine Kyber crystals.

Each crystal has its level of energy (i -th crystal has an energy level of a_i). Each crystal is attuned to a particular side of the force, either the Light or the Dark. Light crystals emit positive energies, while dark crystals emit negative energies. In particular,

- For a light-side crystal of energy level a_i , it emits $+a_i$ units of energy.
- For a dark-side crystal of energy level a_i , it emits $-a_i$ units of energy.

Surprisingly, there are rare neutral crystals that can be tuned to either dark or light side. Once used, it emits either $+a_i$ or $-a_i$ units of energy, depending on which side it has been tuned to.

Given n crystals’ energy levels a_i and types b_i ($1 \leq i \leq n$), $b_i = N$ means the i -th crystal is a neutral one, $b_i = L$ means a Light one, and $b_i = D$ means a Dark one. The Jedi Council asked you to choose some crystals to form a larger hybrid crystal. To make sure it is stable, the final energy level (the sum of the energy emission of all chosen crystals) of the hybrid crystal must be exactly k .

Considering the NP-Hardness of this problem, the Jedi Council puts some additional constraints to the array such that the problem is greatly simplified.

First, the Council puts a special crystal of $a_1 = 1, b_1 = N$.

Second, the Council has arranged the other $n - 1$ crystals in a way that

$$a_i \leq \sum_{j=1}^{i-1} a_j [b_j = N] + \sum_{j=1}^{i-1} a_j [b_i = L \cap b_j = L] + \sum_{j=1}^{i-1} a_j [b_i = D \cap b_j = D] (2 \leq i \leq n).$$

$[cond]$ evaluates to 1 if $cond$ holds, otherwise it evaluates to 0.

For those who do not have the patience to read the problem statements, the problem asks you to find whether there exists a set $S \subseteq \{1, 2, \dots, n\}$ and values s_i for all $i \in S$ such that

$$\sum_{i \in S} a_i * s_i = k,$$

where $s_i = 1$ if the i -th crystal is a Light one, $s_i = -1$ if the i -th crystal is a Dark one, and $s_i \in \{-1, 1\}$ if the i -th crystal is a neutral one.

Input

The first line of the input contains an integer T , denoting the number of test cases.

For each test case, the first line contains two integers n ($1 \leq n \leq 10^3$) and k ($|k| \leq 10^6$).

The next line contains n integer a_1, a_2, \dots, a_n ($0 \leq a_i \leq 10^3$).

The next line contains n character b_1, b_2, \dots, b_n ($b_i \in \{L, D, N\}$).

Output

If there exists such a subset, output “yes”, otherwise output “no”.

Sample Input

```
2

5 9
1 1 2 3 4
N N N N N

6 -10
1 0 1 2 3 1
L L L L L D
```

Sample Output

yes
no

Problem I I am your Father!

“
Darth Vader: “Obi-Wan never told you what happened to your father.”
Luke Skywalker: “He told me enough! He told me you killed him!”
Darth Vader: “No, I am your father.”
— Vader and Luke, on Cloud City
 ”

A list of n force-aware males numbered 1 through n were found. They are the chosen ones that will bring balance to the force. Being listed at the first place, Anakin Skywalker is the ancestor of all rest $n - 1$ persons.

Interestingly, everyone else claims he is the father of some others, causing serious troubles. Fortunately, you found the list also comes with these claims and their likelihood. Your task is to find the true father of Nikana, the last one in the list (numbered n).

There are m claims in the list. The i -th claim consists of three integers: x_i , y_i , and w_i , indicating that the x_i -th person claims he is the father of the y_i -th person, with a likelihood of w_i .

Your task is to find a global assignment that assigns each person (except Anakin Skywalker) to someone in the list, i.e., find $f(u)$ such that:

1. Everyone is assigned a father, i.e., $f(u) \in \{1, 2, \dots, n\}$ for all $u \in \{2, 3, \dots, n\}$.
2. Each one's assigned father claims their relationship, i.e., for all u , there exists a claim i in the claims such that $f(u) = x_i \wedge u = y_i$.
3. Nobody is an ancestor of himself in the assignment, directly or indirectly.
4. The assignment maximizes the sum of the likelihood of the father-and-son relationships, i.e., $W = \sum_i w_i$ if $f(u) = x_i \wedge u = y_i$ is in the assignment.

You should find the father of Nikana (the person numbered n) in such an optimized assignment. If multiple assignments have the same optimal likelihood W , you should find the assignment that minimizes the lexical number of his father, i.e., minimizes $f(n)$ at the same time has an optimal assignment likelihood W . That makes Nikana closer to Anakin Skywalker.

Input

There are multiple test cases in the input file. The first line of the input gives the number of test cases T , then followed by T test cases.

The first line of a test case contains n ($1 \leq n \leq 10^3$) and m ($m \leq 10^4$), the number of persons and the number of claims, respectively.

Then m lines follows. The i -th line contains three integers: x_i , y_i , and w_i indicating the claimed father, son, and likelihood. $1 \leq w_i \leq 100$ is guaranteed. Nobody will claim someone as his son twice.

Output

For each test case, output one line containing two space-separated integers, the maximum likelihood W and the father of Nikana.

Sample Input

```
2
3 3
1 2 10
1 3 10
2 3 10
3 3
1 2 10
1 3 10
2 3 11
```

Sample Output

```
20 1
21 2
```

Problem J Jedi Council

“A Jedi Council was an organized body of Jedi, typically Masters, serving the Jedi Order as an administrative body that governed the Order’s academies, temples, and organizations such as the Jedi Service Corps. All of the Coruscant Councils appointed their own members through unanimous vote, and each had a designated leader. Governing for several centuries, all four Councils were dissolved in 19 BBY following the Sith plot known as Operation: Knightfall and Order 66, both military operations carried out legally by the Grand Army of the Republic.
— Wookieepedia”

The masters of Jedi Council are controversial with approving the proposal of Chancellor Palpatine that the Republic should build a clone army to fight against the separatist attacks after the Naboo Crisis. There has been debates about the proposal, but only a few had a slight feeling of the presence of the coming darkness. Largely, the result of this debate is manipulated by the Dark Lord.

This problem is about how the result of the debate is being changed.

The masters in the Jedi Council are either *aggressive* or *permissive*, and each will vote for his/her opinions. Suppose that there are n masters in the Council and the i -th master has an opinion score w_i of either $+W$ (for an aggressive master), or $-W$ (for an permissive master).

Jedi masters may have influences on each other. Given three masters x_i , y_i , and z_i and parameters $a_i, b_i, c_i, d_i, e_i, f_i$, the level of influence is computed by

$$H_i = a_i|w_{x_i} - w_{y_i}| + b_i|w_{y_i} - w_{z_i}| + c_i|w_{z_i} - w_{x_i}| + d_i(w_{x_i} - d_{y_i}) + e_i(w_{y_i} - w_{z_i}) + f_i(w_{z_i} - w_{x_i}),$$

where w_{x_i} , w_{y_i} , and w_{z_i} are the opinion scores of x_i , y_i , z_i , respectively.

Suppose that there are p influences. The opinion of the Jedi Council is determined by:

$$\mathcal{O} = \sum_{i=1}^n w_i + \sum_{i=1}^p H_i$$

The Dark Lord can silently influence the opinions of Jedi masters. He chose a subset of the masters and silently changed their minds (from aggressive to permissive, or from permissive to aggressive).

Furthermore, there are balances and Force bonds between the masters which should not be broken, otherwise the evil plan will be revealed by the cautious master Yoda. In

particular, there are constraints over the opinions in the form of $w_x \leq w_y$, $w_x = w_y$, or $w_x < w_y$.

Nobody knows the true opinion of the Jedi masters. The only thing we knew is that the Dark Lord is a true master of combinatorial optimization that had changed the minds of the masters such that the opinion of the entire Jedi Council (i.e., the value of \mathcal{O}) is minimized, at the same time no constraint is violated.

It is the time for you to reveal the evil process of the Dark Lord. Given the constraints, you should find a plan that minimizes the Jedi Council's opinion.

Input

The first line of the input contains an integer T .

For each test case, the first line contains four integers n the number of Jedi masters ($1 \leq n \leq 500$), W the absolute value of their opinion scores ($0 \leq W \leq 10^6$), p the number of influences between Jedi masters ($0 \leq p \leq 1000$), q the number of constraints ($0 \leq q \leq 1000$).

Then p lines follows, each contains 9 integers $x_i, y_i, z_i, a_i, b_i, c_i, d_i, e_i, f_i$, as mentioned in the problem ($1 \leq x_i, y_i, z_i \leq n$, $0 \leq a_i, b_i, c_i, d_i, e_i, f_i \leq 1000$).

The following q lines describe the constraints, each line contains three integers, x, y, r .

- $r = 0$ indicates a constraint in the form of $w_x \leq w_y$.
- $r = 1$ indicates a constraint in the form of $w_x = w_y$.
- $r = 2$ indicates a constraint in the form of $w_x < w_y$.

The input guarantees at least one solution exists.

Output

Output one line for each test case, the minimized Jedi Council's opinion.

Sample Input

```
1
3 1 1 1
1 2 3 1 1 1 1 1 1
1 2 2
```

Sample Output

```
3
```

Problem K Killer Names

“Galen Marek, codenamed Starkiller, was a male Human apprentice of the Sith Lord Darth Vader. A powerful Force-user who lived during the era of the Galactic Empire, Marek originated from the Wookiee home planet of Kashyyyk as the sole offspring of two Jedi Knights—Mallie and Kento Marek—who deserted the Jedi Order during the Clone Wars. Following the death of his mother, the young Marek’s father was killed in battle by Darth Vader. Though only a child, Marek possessed an exceptionally strong connection to the Force that the Dark Lord of the Sith sought to exploit. When Marek died in 2 BBY, shortly after the formation of the Alliance, Vader endeavored to recreate his disciple by utilizing the cloning technologies of the planet Kamino. The accelerated cloning process—an enhanced version of the Kaminoan method which allowed for a rapid growth rate within its subjects—was initially imperfect and many clones were too unstable to take Marek’s place as the Dark Lord’s new apprentice. After months of failure, one particular clone impressed Vader enough for him to hope that this version might become the first success. But as with the others, he inherited Marek’s power and skills at the cost of receiving his emotions as well, a side effect of memory flashes used in the training process.
— Wookieepedia”

Darth Vader is finally able to stably clone the most powerful soldier in the galaxy: the Starkiller. It is the time of the final strike to destroy the Jedi remnants hidden in every corner of the galaxy.

However, as the clone army is growing, giving them names becomes a trouble. A clone of Starkiller will be given a two-word name, a first name and a last name. Both the first name and the last name have exactly n characters, while each character is chosen from an alphabet of size m . It appears that there are m^{2n} possible names to be used.

Though the clone process succeeded, the moods of Starkiller clones seem not quite stable. Once an unsatisfactory name is given, a clone will become unstable and will try to fight against his own master. A name is safe if and only if no character appears in both the first name and the last name.

Since no two clones can share a name, Darth Vader would like to know the maximum number of clones he is able to create.

Input

The First line of the input contains an integer T ($T \leq 10$), denoting the number of test cases.

Each test case contains two integers n and m ($1 \leq n, m \leq 2000$).

Output

For each test case, output one line containing the maximum number of clones Vader can create.

Sample Input

```
2
3 2
2 3
```

Sample Output

```
2
18
```