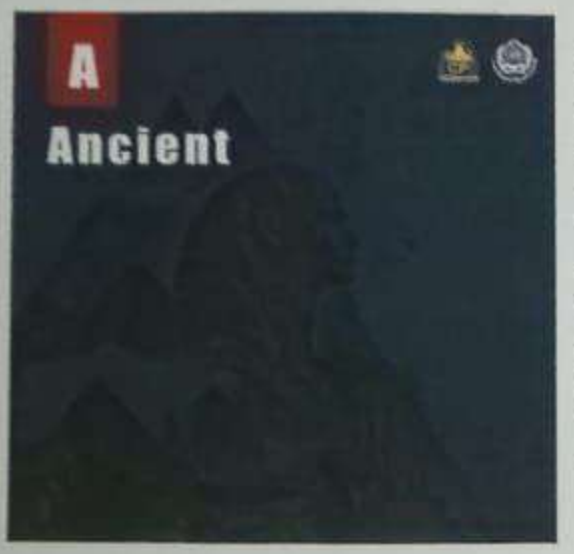
Problem A. Ancient

Input file: standard input
Output file: standard output
Balloon Color: Red



In the hushed sands of time, a story unfolds, tracing back over 5,000 years to the birth of an ancient civilization along the banks of the Nile. Egypt's history, steeped in mystery and grandeur, weaves tales of ancient Egyptians, pyramids, and a timeless legacy that continues to captivate the world to this day.

Waleed, a determined archaeologist, and Manal, a young historian, unite to unravel Egypt's enigmatic past. Their shared journey leads them through the ages, revealing secrets that will reverberate through time, as they uncover the untold tales of the mighty ancient Egyptians and the lost wonders of an ancient world.

Waleed recently found an ancient papyrus hidden in the rubbles of an ancient city he is exploring. The papyrus was encrypted but Waleed could understand what it is about. It contains what looks like an array A of n integer numbers.

Waleed also found some encrypted text in the same room where he found the papyrus. With Manal's help, they could decrypt the message in the text. It says: "The answer to $sup(l, r)$ $(l \leq r)$ is the **largest integer** x, such that the number of occurrences of x in the subarray from l to r in A is **at least** x.".

There was another encrypted papyrus in one corner of the room. This papyrus, after decryption, contains q questions about the encrypted array. The i-th question is about a certain L_i and R_i. Waleed and Manal could answer $sup(L_i, R_i)$ for all of them.

Encouraged by that, you are determined to follow their footsteps and do the same. However, you could only find the original encrypted papyruses. Now you need to decrypt them and solve the questions. The answer required here is the summation of the answers of all questions.

Input

The first line of the input contains 4 integers n, m, p and k $(1 \leq k \leq m \leq n \leq 3 \cdot 10^5)$, $(1 \leq p \leq 10^6)$. The array A consists of n integers.

The second line of the input contains m integers $A_1, A_2, ..., A_m$ $(1 \leq A_i \leq 10^6)$. For the rest of the array where $m+1 \leq i \leq n$, $A_i = ((\sum_{j=i-k}^{i-1} A_j) \bmod p) + 1$.

The third line of the input contains 4 integers q, c, v and b $(1 \leq q \leq 3 \cdot 10^5, 1 \leq c, v, b \leq 10^3)$. q is the total number of questions. Now let's create two arrays: $Lefts$ and $Rights$ $(Lefts_0 = Rights_0 = 0)$.

The next c lines represnting the first c questions. Each line of them contains 2 integers represnting L_i and R_i $(1 \leq L_i \leq R_i \leq n)$. For the rest of the questions where $c+1 \leq i \leq q$, $L_i = 1 + ((\sum_{j=i-c}^{i-1} Lefts_j) \bmod n)$, and $R_i = 1 + ((\sum_{j=i-c}^{i-1} Rights_j) \bmod n)$.

$Lefts$ and $Rights$ are computed as follows: for $1 \leq i \leq q$, let's compute $G_i = (Lefts_{i-1} + L_i * (Ans_i + v))$ mod n, and $H_i = (Rights_{i-1} + R_i * (Ans_i + b))$ mod n, then $Lefts_i = min(G_i, H_i)$, and $Rights_i = max(G_i, H_i)$. Ans_i is the answer of the i_{th} question.

Output

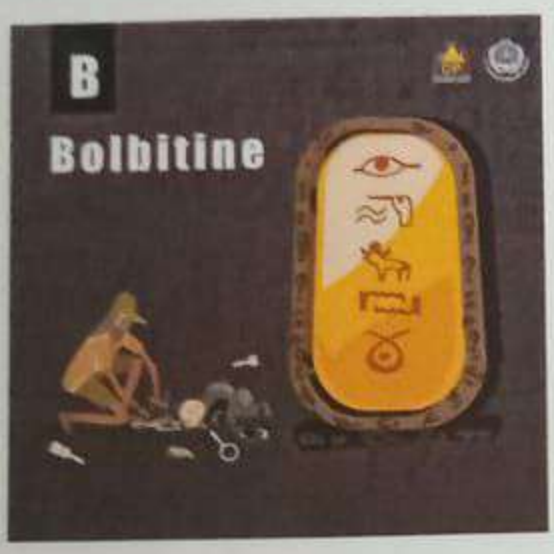
Print a single integer, the summation of answers of the questions.

Example

standard input	standard output
6 4 5 3 3 4 2 5 10 4 2 3 1 3 2 6 3 5 4 4	10

Problem B. Bolbitine

Input file:	standard input
Output file:	standard output
Balloon Color:	Black



In the year 1799, an intriguing stone slab, laden with three unique scripts, surfaced near the town of Bolbitine. An enigma etched in stone, it bore the key to unlocking ancient Egyptian hieroglyphs - the Rosetta Stone. Today, a replica stands in its discovery place, the town of Bolbitine, also known as Rosetta or Rashid.

Endure Capital, the life long partner of ACPC, looks for startup teams with great ideas and, more importantly, relentless execution to build companies that achieve hyper-growth. Since life grows to be more complex with new unknown everyday, Endure Capital seeks entrepreneurs capable to taking Rosetta stone like challenges bringing light into the world.

Tarek, Endure's Managing Partner, found a new Rosetta stone. That stone defines a sub-sequence of a string as *Mythical* if no two consecutive letters in the sub-sequence are equal.

Tarek also found a string S on a papyrus next to the stone. The papyrus also contains some ancient text that says: "In the string S resides an enormous *Mythical* sub-sequence. It is a *Mythical* sub-sequence with the largest number of letters among all other *Mythical* sub-sequences".

In the string S, Tarek could find all enormous *Mythical* sub-sequence. Now he is looking for others who can do the same. Can you?

Since the number of *Mythical* sub-sequences that satisfy the condition can be too large. print it modulo $10^9 + 7$.

Input

The first line contains an integer t ($1 \leq t \leq 10^5$), the number of test cases. The first line of each test case contains a string S ($1 \leq |S| \leq 3 \times 10^5$). It it guaranteed that the total $\sum |S|$ over all test cases should be at most 3×10^5 where $|S|$ is the length of a string S.

Output

For each test case, print two integers: the largest length of all possible *Mythical* sub-sequences in S and the number of *Mythical* sub-sequences in S that have the largest length.

Example

standard input	standard output
3 abaabc aba acccaa	5 2 3 1 3 6

Problem C. Cleopatra

Input file:	standard input
Output file:	standard output
Balloon Color:	Light Blue

Once upon a time, there was a legendary queen named Cleopatra, ruling over ancient Egypt around 2,000 years ago, from 51 BCE to 30 BCE. Her story seems so ancient to us now. But wait, here's a fascinating twist! The great pyramids, those incredible structures, were already standing tall roughly 3,000 years before her era! That means her time is much closer to ours than it was to the age of those majestic pyramids. It's mind-boggling to think just how ancient these pyramids truly are!

Fascinated by queen Cleopatra, young Maha is determined to pursue her passion and finish her studies with highest degrees. Maha is doing a research and looking for a topic S on a search engine.

On this search engine, Maha can do any of the following operations any number of times in any order:

- Press *a letter* key on the keyboard to type a lowercase English letter (the pressed letter).
- Press the *backspace* key to delete the last character typed in the search engine (assuming that the typing cursor is always at the end of the string within the search box). Nothing happens if the string is empty.
- Scroll through the list of suggested strings by pressing the *down* arrow key as many times as she wants, and then select one of them by pressing the *enter* key. In this case, the search box will show the string that she chooses, and the typing cursor will be at the end of the string as well.

This search engine has n suggestion strings $T_1, T_2, \ldots, T_n$.

Assume that the current string in the search box is Cur then string A is displayed before string B in the list if:

- The length of the longest common prefix (lcp) between Cur and A is strictly greater than the lcp between Cur and B. Otherwise,
- In case of a tie, A is lexicographically smaller than B.

You will be given the strings $S, T_1, T_2, \ldots, T_n$ and the cost of pressing the keys a, b, c, ..., z, *backspace*, *enter*, *down*.

Find the minimum possible cost required to type S, assuming that Maha has not typed any character in the search box yet.

Input

The first line contains one integer t ($1 \le t \le 10^5$) The number of test cases.

The first line of each test case contains the string S ($1 \le |S| \le 2 \times 10^6$).

The second line of each test case contains a single integer n ($1 \le n \le 2 \times 10^6$) the number of suggestion strings in the search engine.

The following n lines contains the strings T_i ($1 \le i \le n$), ($1 \le |T_i| \le 2 \times 10^6$).

The following line consists of 26 space-separated integers $C_a, C_b, \ldots, C_z$ ($0 \le C_a, C_b, \ldots, C_z \le 10^6$) the cost of pressing each English letter key.

The following line consists of 3 space-separated integers $C_{backspace}$, C_{enter} and C_{down} ($0 \le C_{backspace}, C_{enter}, C_{down} \le 10^6$) the cost of pressing the backspace key, the enter key, and the down arrow key respectively.

It is guaranteed that the $\sum |S|$ and $\sum |T_i|$ across all test cases does not exceed 2×10^6.

Output

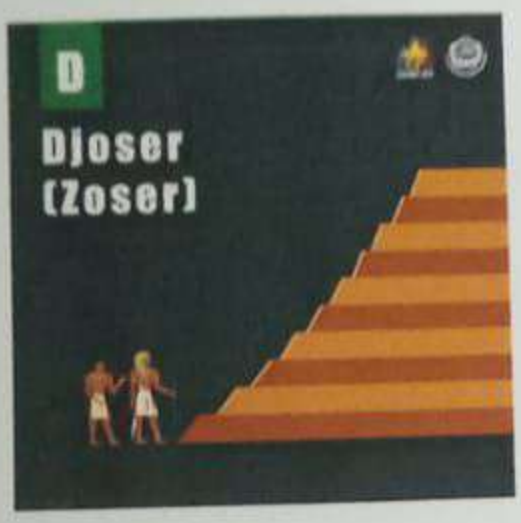
For each test case print a single integer representing the minimum possible cost required to type the string S.

Example

standard input	standard output
1 algorithm 3 altruistic algorithms allergic 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 1	5

Problem D. Djoser (Zoser)

Input file:	standard input
Output file:	standard output
Balloon Color:	Dark Green



In the ancient land of Egypt, during the 27th century BCE, a mighty king named Djoser reigned. His name echoed across time, for he embarked on a remarkable endeavor—the construction of a groundbreaking step pyramid at Saqqara.

With the ingenious architect Imhotep at his side, Djoser's pyramid rose, a marvel of its age. This grand monument, the earliest large-scale stone structure, heralded a new era in Egyptian funerary architecture, captivating the imagination of those who seek the mysteries of ancient Egypt, including young archaeology enthusiast Adel.

Adel is amazed by the great architecture of the pyramid. He used to go and study it. Once he found an ancient papyrus in one of the newly discovered hidden rooms. The papyrus talks about a cubic equation $a \times x^3 + b \times x^2 + c \times x + d = 0$.

The papyrus also has several different a, b, c and d values. It asks to find any integer x that solves this equation, or report that there is no integer solution.

The papyrus also says that there might be multiple integer solution. In that case, any one of them is valid.

The papyrus guarantees that if there is an integer solution, then it's less than or equal to 10^9, and greater than or equal to -10^9.

Input

The first line contains one integer t, the number of test cases.

Each test case consists of one line containing four integers a, b, c, and d ($-3 \times 10^4 \leq a, b, c, d \leq 3 \times 10^4$) ($a \neq 0$), the coefficients of the cubic equation.

Output

For each test case print 'Yes' if there is any integer x that solves the equation, 'No' if there is No integer solution for the given equation.

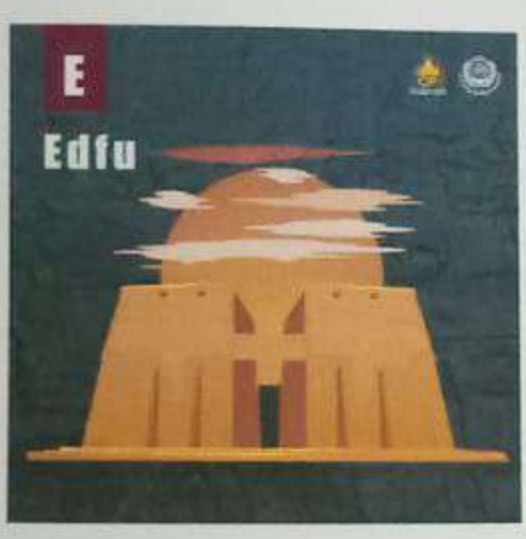
If the answer is 'Yes', print in the second line one integer x ($-10^9 \leq x \leq 10^9$), the solution for the cubic equation.

Examples

standard input	standard output
2 1 6 -64 96 1 -2 9 -36	Yes -12 Yes 3
2 1 1 2 -12 6 425 2539 -5440	No Yes -64
4 1 0 0 0 1 -1 1 -1 1 1 1 1 2 2 -23 443	Yes 0 Yes 1 Yes -1 No
1 21 222 -32 124	No

Problem E. Edfu

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Purple`



In a cozy café in Edfu, a city known for its big well-preserved temple, Ewaily and Lilia chatted excitedly about their love for ancient Egypt. They dreamed of traveling back to Ancient Egypt to see these wonders with their own eyes. Lilia and Ewaily heard about the time machine invented in Giza. They spoke with Amira and she allowed them to use it for one trip. They went back in time to visit Ancient Egypt.

They saw how Ptolemy II of Alexandria dispatched engineers across empires to enhance civilization through innovative solutions. Lilia noticed that this similar to Qetraa, a 21st-century talent acquisition firm, which connects technology talents across Europe sharing expertise to construct groundbreaking technology solutions. Both Ptolemy II and qetraa bridge cultures and eras, illustrating how collaboration and knowledge exchange transcend time, shaping advancements and uniting engineers for common goals.

While separated by centuries, these instances highlight the enduring thread of cross-border cooperation in propelling technology-driven progress. A lesson for Ewaily and Lilia to use in their modern time. while in ancient Egypt, they learned about a place in Heliopolis where many papyruses are stored. They came back to modern time and immediately told their friend Yomna, the archeologist. Together, they found a new papyrus that contains a challenge.

The papyrus challenges the reader to construct any permutation P of size n that satisfies the following:

- let's define S as an array of all subsequences of P of size m.
- if we sort the array S in ascending order, then the first element of the array S after sorting is equal to a given array A.

The papyrus gives the reader two integers n, and m and an array A of size m of distinct elements. Then asks if the reader can construct a permutation P as described or report that there is no such permutation.

Input

The first line contains one integer t, the number of test cases.

The first line of each test case contains two space-separated integers n, and m ($1 \leq m \leq n \leq 10^5$), the size of permutation P you have to construct, and the size of the array A you are given in the input.

The second line of each test case contains m space-separated distinct integers represents the array A ($1 \leq A_i \leq n$).

Output

For each test case, print 'Yes' if you can construct any permutation P that satisfies the conditions above. Print 'No' if there is no such permutation.

If you print 'Yes' in a test case, then you should print in the next line one permutation P of size n.

Example

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

Note

A subsequence is a sequence that can be derived from the given sequence by deleting zero or more elements without changing the order of the remaining elements.

It's guaranteed that the sum of n over all the test cases is less than or equal to 3×10^5.

Problem F. Fayoum

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Yellow`

In the western desert of Egypt, lies the ancient city of Fayoum, where history spans not only thousands of years but millions. A city that is filled with countless natural and historical wonders such as Lake Qarun and Wadi Al-Rayyan.

Of all the interesting archaeological sites, Amin found Wadi Al Hitan to be the most extraordinary site that reveals a rich fossil record of ancient marine life from the Eocene epoch. Among its wonders are fossilized whale skeletons and bones, revealing precious insights into the ancient ancestors of today's magnificent whales.

Even there, Amin could find some ancient papyrus. One of them described a puzzle left by brilliant engineers. The papyrus talks about an array A. It says that a subarray is good if the sum of values in it is k or greater.

The papyrus also describes a useless index as an index i such that if by removing A_i alone from the sum of all good subarrays that contain i, they remain good subarrays and each of them still have a sum that is k or greater.

Amin also found some another papyrus. It contains an array A of length n and a number k. Can you find the number of useless indices in that array?

Input

The first line contains two integers n and k ($1 \le n, k \le 10^5$).

The second line contains n integers $A_1, A_2, ..., A_n$ ($1 \le A_i \le 10^5$), the elements of the array A.

Output

Print the number of useless indices.

Examples

standard input	standard output
4 4 1 4 2 3	1
6 10 15 4 12 10 6 20	2
3 10 3 3 3	3

Note

In the first example, the $1st$ index is useless.

In the second example, the $2nd$ and the $5th$ indices are useless.

In the third example, all indices as useless. Note that if index i is in 0 good subarrays, then removing i from the 0 subarrays results in 0 good subarrays. Since index i didn't affect the number of good subarrays, it is useless.

Problem G. Giza

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Light Green`

In ancient history, Giza city witnessed humanity's most astounding achievement—the Great Pyramids. The majestic structures of Khufu, Khafre, and Menkaure rose on the Giza Plateau, Egypt. Enduring through time, these iconic monuments captivate the world, a testament to the enigmatic allure of ancient engineering prowess. An ancient papyrus was found that might reveal a lot of ancient history. The papyrus talks about Den VC.

In the mystical land of Den VC, a Venture Capitalist operating in Africa, renowned for its futuristic innovations, a daring adventure was set in motion. A brilliant startup from their portfolio devised an audacious plan to sponsor the construction of ancient pyramids in 3000 B.C. With the assistance of another portfolio company specializing in flying cranes, the ingenious team created a time machine.

Whirling through time, they reached the past, bringing along their advanced technology. Collaborating with skilled artisans, they erected the majestic rocks of the pyramids at a remarkable pace. The melding of ancient and modern left an enigmatic legacy as the pyramids soared into the skies, a testament to limitless possibilities across time. All cranes and operators returned safely to the modern era.

Amira, Den VC's Fund Operations Manager, is finalizing the plan to build the praymids. She has a few more great decisions to take. One decision is about which color should the Great Pyramid be painted with. Amira likes to involve her team in that crucial decision. There are n people in Amira's team. Each one will vote exactly once for one color out of k different colors.

Amira calls the voting process determinate if and only if after all the n people have voted, there is exactly one choice that has the max number of votes regardless of how the n people vote. In other words, there is exactly one choice with the max number of votes for every possible voting combination.

Given n and k, print 'Yes' if the voting process with n people and k choices is determinate, and print 'No' otherwise.

Input

The first line contains one integer t, the number of test cases.

Each test case consists of exactly one line containing two space-separated integers n and k ($1 \leq n, k \leq 10^9$), the number of people who are voting, and the number of color choices in the vote.

Output

For each test case, print one line contains either 'Yes' or 'No' (without quotation), 'Yes' if the voting process is determinate, and 'No' otherwise.

Example

standard input	standard output
5 1 3 2 1 3 2 4 2 5 3	Yes Yes Yes No No

Problem H. Heliopolis

Input file:	standard input
Output file:	standard output
Balloon Color:	White

Long ago, the city of Heliopolis stood tall in what is now Cairo. It had big stone pillars that reached for the sky, showing people's interest in the stars and the sun. It was a place full of learning and big ideas. Heliopolis still leaves a mark on history, inviting us all to dig deeper and learn more about the past.

Even when modern day life has taken over the place, ancient papyruses are unearthed daily. This became more frequent after the important tips from Ewaily and Lilia which Yomna, the archeologist, received. Yomna recently found a few of them. They describe a set of queries to be using two strings P and S. One papyrus says that S is initially empty.

Another papyrus talks about performing q queries that modify the string S in some way, and after each query i the resulting string S will be referred to as T_i.

Each query is one of the following:

- 1 c: add a given lowercase English character c to the end of the current string S.
- 2 c: add a given lowercase English character c to the beginning of the current string S.
- 3 j: concatenate the string T_j from the j_{th} query to the end of the current string S. The papyrus guarantees that j is a query that happened already.
- 4 j: concatenate the string T_j from the j_{th} query to the beginning of the current string S. The papyrus guarantees that j is a query that happened already.

The last papyrus challenges the reader to print the number of occurrences of P in S modulo 10^9+7 after each query. Yomna with her team could solve this challenge. Can you?

Input

The first line of the input contains a string P consisting of lowercase English letters, where $(1 \leq |P| \leq 10^5)$, where $|P|$ is the length of P.

The second line contains a single integer q $(1 \leq q \leq 10^3)$, The number of queries.

Each of the next q lines describes a single query as mentioned in the statement.

Output

For each query print a new line containing a single integer, the answer needed after the current query.

Example

standard input	standard output
1 ab 7 1 a 1 b 3 2 4 1 1 a 2 b 4 3	0 1 2 2 2 2 4

Problem I. Imhotep

Input file: standard input
Output file: standard output
Balloon Color: Silver

Imhotep was a brilliant man who served as the chief minister, architect, and physician of King Djoser in ancient Egypt. He designed the first step pyramid at Saqqara, which was a marvel of engineering and a symbol of royal power. He was also skilled in astronomy, mathematics, and medicine, and wrote many books and papyruses on various subjects.

Ayman, a young explorer and engineer, was once walking near the pyramid of Djoser. He found an ancient papyrus written by Imhotep himself. The papyrus describes a challenge. It has three integers n, l, r. Then Imhotep challenges the reader to count the number of arrays of size $n+1$ that have the first element as the average of the whole array, and every element of it is between l and r inclusive.

Since the result might be too large, Imhotep wants the answer modulo 10^9+7.

Can you solve Imhotep's challenge?

Input

The first line contains one integer t, the number of test cases.

Each test case contains 3 space-separated integers n, l, and r ($1 \le n \le 3000, 1 \le l \le r \le 10^{18}$)

It's guaranteed that the sum of n over all the test cases is less than or equal to 3000.

Output

For each test case print one integer, the answer to the test.

Example

standard input	standard output
2 5 1 10 4 2 7	20000 322

Problem J. Jewels

Input file: standard input
Output file: standard output
Balloon Color: Orange

Diving into ancient Egypt's rich past, we've discovered so many jewels. Take a tour on the Nile. Ancient wonders abound, a tapestry of history. Carved in stone, secrets veiled in mystery. A journey through time, on the majestic Nile.

From Aswan in the south to Alexandria in the North, a beacon of science in Egypt and the Arab region shines. The Arab Academy for Science and Technology (AAST), the ACPC head quarter, is an effective agent in achieving sustainable economic and social development.

AAST's vision is to be a smart educational institution with a positive impact on the knowledge society through research, creativity, innovation, and entrepreneurship. With that, it continues to find and refine very important jewels, the brilliant students themselves.

As the ECPC host, AAST hosts a great number of jewels every year to participate in the ECPC. Ossama, the operations lead, monitors the number of teams year to year on some very delicate papyruses. His papyruses shows that ECPC had a peak of 2500 teams in 2022. Ossama is interested in knowing if this year is exceptional for ECPC or not. Ossama defines an exceptional year as one year that has at least 2500 teams after having strictly less than 2500 teams in the previous year.

Given t the number of teams participating this year, and d the difference of the number of teams between this year and the previous year. Determine this year is exceptional or not.

Input

The input contains two space-separated integers t and d $(0 \leq t \leq 3000)$, $(-300 \leq d \leq 300)$, this year's number of teams, and the difference between this year and last year.

Output

Print "Yes"if this year is exceptional. Otherwise, print "No". The printed answer is without quotes.

Examples

standard input	standard output
2323 178	No
2600 300	Yes
2505 0	No
2509 -10	No
2509 11	Yes

Problem K. Karnak

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	`Dark Blue`

In the ancient ruins of Karnak City near Luxor, Sara was amazed. The magnificent Karnak Temple Complex, stood before her. The grand temples and statues showcased the brilliance of ancient Egyptian architecture. As she explored the sacred site, Sara imagined the elaborate religious ceremonies that once made Karnak the spiritual heart of Egypt. The whispers of history enveloped her, urging her to uncover the secrets of this timeless place.

Walking around Karnak, Sara found an ancient papyrus. The papyrus describes an array A of length n. The papyrus has a puzzle asking about the number of **good subsets**.

The papyrus also says that a subset S is called good if **all** the following conditions are satisfied:

- The size of S is equal to 4.
- $S_2 \bmod S_1 = 0$ (S_1 divides S_2).
- $S_3 \bmod S_4 = 0$ (S_4 divides S_3).
- $S_2 = S_3$.

Sara could solve the puzzle. Can you?

Since the number of such subsets can be very large, compute it modulo $10^9 + 7$.

Input

The first line of the input contains a single integer t ($1 \le t \le 10^3$) - the number of test cases.

The first line of each test case contains a single integer n ($1 \le n \le 10^5$) - the size of the array.

The second line of each testcase contains n integers describing the array A ($1 \le A_i \le 10^5$)

It's guaranteed that the $\sum n$ over all testcases doesn't exceed $3 \cdot 10^5$.

Output

For each test case, print the answer to that test case.

Example

standard input	standard output
9 10 4 4 6 5 4 3 6 6 4 6 10 5 5 3 6 4 3 6 3 5 5 10 3 5 6 5 6 6 6 4 5 4 10 6 3 6 6 4 4 4 4 4 3 10 3 5 5 6 6 6 6 3 3 4 10 4 5 5 4 6 4 5 3 4 3 10 5 5 3 4 5 3 6 4 6 6 10 3 5 3 4 5 6 5 4 4 3 10 3 5 4 6 3 4 6 6 3 5	3 2 5 7 25 1 2 0 6

Problem L. Luxor

Input file:	standard input
Output file:	standard output
Balloon Color:	Bronze

Luxor, the "Hundred Gates City,"boasts the iconic Luxor Temple at its heart. Dedicated to the Theban triad of Amun, Mut, and Khonsu, this ancient masterpiece showcases grand statues, towering obelisks, and intricate hieroglyphics. A living relic of human civilization, the temple exudes an ethereal charm, especially when illuminated by the setting sun.

Lily, a young adventurer, was visiting Luxor Temple when she a very interesting ancient papyrus hidden in a small crack in a wall. This papyrus talks about permutations construction.

Lily could read the papyrus and shared its content with the ECPC. The papyrus wants to construct a permutation P of n integers such that $\sum_{i=1}^{n} |P_i - i| = k$. The papyurs also has some combinations of different n and k and challenges the reader to construct a valid permutation of size n satisfying the condition as described or determine that it is impossible. Lily and her team of adventurers could solve the challenges in the papyrus. Can you?

Input

The first line contains an integer t, the number of test cases.

The first line of each test case contains two space-separated integers n and k $(1 \leq n \leq 10^5)$, $(1 \leq k \leq 10^9)$, the two numbers from the papyrus.

It is guaranteed that the sum of n over all test cases does not exceed 3×10^5.

Output

For each test case, if it is possible to construct such a permutation print "Yes" and then n integers: the permutation P that satisfies the papyrus' condition. Otherwise print "No".

Example

standard input	standard output
6 2 2 2 1 2 0 4 2 4 6 7 4	Yes 2 1 No Yes 1 2 Yes 2 1 3 4 Yes 4 2 3 1 Yes 3 2 1 4 5 6 7

Problem M. Memphis

Input file:	`standard input`
Output file:	`standard output`
Balloon Color:	Pink

In ancient Egypt, Memphis stood as the first capital of the unified country, founded around 3100 BC by King Menes. This influential city witnessed the rise and fall of many dynasties and kings, flourishing as a cultural and artistic hub. Grand monuments, temples, and statues adorned its landscape. However, Memphis's significance waned with the ascent of Thebes and Alexandria, eventually leading to its abandonment and burial under the sand.

An ancient papyrus was found recently where once Memphis stood. The papyrus talks about permutations and magic indices. It says that for any permutation P of size n, an index i $(1 \leq i \leq n-1)$ as a magic index if and only if $P[i] > P[i+1]$.

Moamen heard about this papyrus in the news and started thinking about it. He wants to compute the number of permutations P of size n, that have exactly k magic indices.

Since this number can be very large, he wants to compute it modulo $10^9 + 7$.

Input

The first line contains one integer t, the number of test cases.

Each test case consists of one line. This line contains two space-separated integers n k $(1 \leq n \leq 1000)$, $(0 \leq k \leq n-1)$, the size of the permutation, and the number of magic indices.

Output

For each test case print one integer, the answer Moamen seeks modulo $10^9 + 7$.

Example

standard input	standard output
4 2 1 3 2 4 0 4 2	1 1 1 11

Problem N. Nefertiti

Input file:	standard input
Output file:	standard output
Balloon Color:	Gold

Enthralled by Nefertiti, an ancient Egyptian queen, Emy found inspiration in her influential role during the Amarna Period. As King Akhenaten's principal wife, Nefertiti played a powerful role in state affairs and became one of ancient Egypt's most visible queens. Her captivating bust, unearthed in 1912, stands as a timeless masterpiece of ancient Egyptian art. However, many aspects of Nefertiti's later life and fate continue to intrigue historians and scholars.

Emy went on a journey to discover more about Nefertiti. On her journey, she found an ancient papyrus describing a monster with h health points.

The papyrus also describes a warrior who fights the monster and can do n special moves. Each move i has two values P_i and D_i which describe the move. It means that the probability of move i to happen is $\frac{P_i}{10^6}$. When move i happens, it reduces the monster's health points by D_i.

Each second the warrior hits the monster once. This hit can be any of the n moves. The fight ends if and only if the monster's health points becomes nonpositive.

Emy wonders about the probability that the fight ends after at most t seconds. Can you help her find out the answer?

Let $P = 998244353$. It can be shown that the answer can be expressed as an irreducible fraction $\frac{a}{b}$, where a and b are integers and $b \not\equiv 0 \pmod{P}$. Output the integer equal to $a \cdot b^{-1} \bmod P$. In other words, output an integer z such that $0 \le z < P$ and $z \cdot b \equiv a \pmod{P}$.

Input

The first line contains three integers n, h, t $(1 \le n, h \le 10^5)$, $(1 \le t \le 10^9)$.

Then n lines follow, the $i-th$ of which contains two contains two integers P_i $(0 \le P_i \le 10^6)$ and D_i $(0 \le D_i \le H)$.

It is guaranteed that the sum of P_i of all the moves is equal to 10^6.

Output

Print the probability of ending the fight after t seconds mod 998244353.

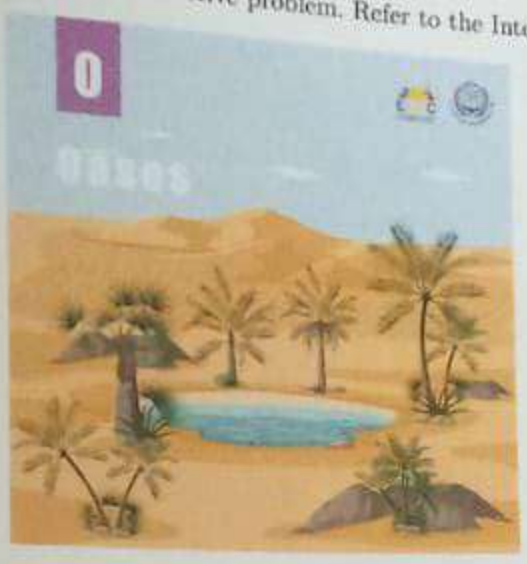
Examples

standard input	standard output
3 100 3 800000 10 100000 20 100000 50	523080041
3 100 4 800000 10 100000 20 100000 25	796898467
5 100000 1000000000 50000 234 150000 442 200000 0 250000 9387 350000 14825	93858897

Problem O. Oases

Input file:	standard input
Output file:	standard output
Balloon Color:	Light Purple

This is an interactive problem. Refer to the Interaction section below for better understanding.



In the vast expanse of Egypt's desert, secret havens, Siwa, Kharga, Dakhla, and Bahariya, emerged as mirage-shrouded oases. Each, home to the resilient Date Palm, stood as a beacon of life amidst aridity. These sanctuaries provided refuge to weary travelers, their rejuvenating powers etched in age-old legends. Wrapped in an enigma, they awaited a deserving wanderer to discover their true potential. And so unfurls the tale of Egypt's elusive oases, each a mystery nestled in the desert's heart.

Even in the heart of the desert, secrets can be found. A new papyrus appears. This time, it is from an ancient brilliant engineer, Resli. The papyrus talks about n hidden points in 2D XY plane that Resli once knew. There was no info about the points themselves on the papyrus except for a task that Resli created.

The task is to find any subset of those n points (let's call this subset S) that satisfy the following conditions:

- The sum of the x coordinates for all the points in S is divisable by $|S|$.
- The sum of the y coordinates for all the points in S is divisable by $|S|$.

Where $|S|$ is the number of points in S.

Very close where the papyrus was found, something that looks like an ancient robot was found. The robot had a counter that says 300 and next to it an ancient text that says "remaining number of questions". A description of what a question means was written below the counter.

Each question asks whether a certain set of points satisfies the above conditions or not. Each question is in the following form:

? k i_1 i_2 ... i_k

It starts with '?' then a number k ($3 \leq k \leq N$), the number of points in the chosen set. This is followed by k integers representing the indices of the hidden points in some set you choose. Note that the K indices should be distinct or the robot will break and you are going to receive **WA** as a verdict.

If the above conditions are satisfied for the chosen set, the robot will answer by **Yes**, otherwise the answer is **No**.

At any point of the interaction, if you want to guess the needed correct subset, output the set in the following form:

! k i_1 i_2 ... i_k

It starts with '!' then a number k ($3 \leq k \leq N$), the number of points in the set and then k integers, the indices of the chosen set. The indices should be pair-wise distinct. This is not counted as a question. If your chosen set doesn't satisfy the conditions, the robot will break and you are going to receive **WA** as a verdict.

Note: it's guranteed that the points are generated such that there is always at least one subset that satisfies the conditions.

Input

The first line of the input contains a single integer t ($1 \le t \le 100$) - the number of test cases.

The first line of each test case contains a single integer n ($3 \le n \le 100$), the number of hidden points.

All indices printed in a question or the answer are between 1 and n. Otherwise, the robot will break and you are going to receive **WA** as a verdict.

Each test case has its own unique 300 questions counter.

Interaction Protocol

To guess a correct set of points that satisfies the conditions, you can ask questions to the robot no more than 300 times. Each question should be printed in it's own line and have the form ? k i_1 i_2 ... i_k as described above. You have to both print the end-of-line character and flush the output. After flushing you should read the answer for this question from input.

After each question, the robot prints one line "Yes"or "No"(without quotes) in input stream. "Yes"is printed when the set in your question satisfies the conditions and "No"otherwise.

When you are ready to guess the correct set, print a line in the following form ! k i_1 i_2 ... i_k as described above. If it is incorrect, the robot will break and you are going to receive **WA** as a verdict. Otherwise, you will read a new n for the next test case or the interaction ends if there are no more test cases.

To flush you can use (just after printing an end-of-line):

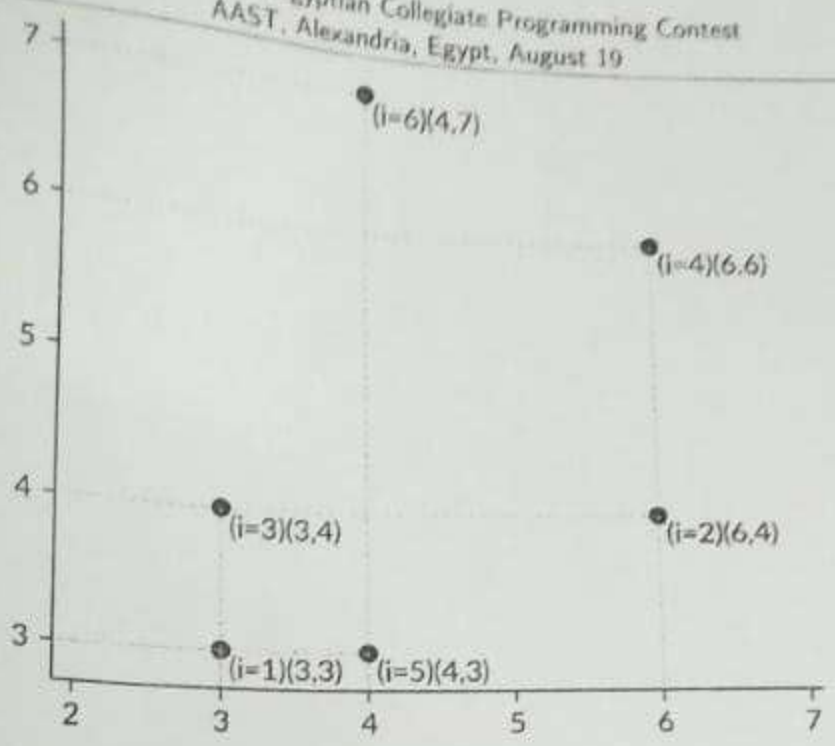
- fflush(stdout) in C++;
- System.out.flush() in Java;
- stdout.flush() in Python;

Example

standard input	standard output
1	? 5 1 2 3 5 6
6	? 4 1 2 3 4
No	? 6 1 2 3 4 5 6
No	? 4 1 2 4 5
No	? 4 1 3 4 5
No	! 4 1 3 4 5
Yes	

Note

The points in the sample are: (3, 3), (6, 4), (3, 4), (6, 6), (4, 3), (4, 7).


7
6
5
4
3
2
3
4
5
6
7
(i=6)(4,7)
(i=4)(6,6)
(i=3)(3,4)
(i=2)(6,4)
(i=1)(3,3)
(i=5)(4,3)